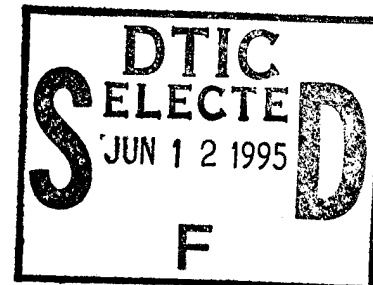


NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



THESIS

**ANALYSIS OF THE ARMY'S HORIZONTAL
TECHNOLOGY INTEGRATION POLICY: A
CASE STUDY OF THE SECOND-GENERATION
FORWARD-LOOKING INFRARED PROGRAM**

by

Karl Scott Flynn

March 1995

Thesis Advisor:

John T. Dillard

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DTIC QUALITY INSPECTED 5

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REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 1995	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE ANALYSIS OF THE ARMY'S HORIZONTAL TECHNOLOGY INTEGRATION POLICY: A CASE STUDY OF THE SECOND- GENERATION FORWARD-LOOKING INFRARED PROGRAM			5. FUNDING NUMBERS	
6. AUTHOR(S) Flynn, Karl Scott				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) <p>This study was undertaken to analyze and document the Army's current policy and guidance governing the Horizontal Technology Integration (HTI) strategy. HTI increases common situational awareness and reduces Life Cycle Cost by simultaneously integrating multiple platforms with developing technologies. The Second-Generation Forward-Looking InfraRed HTI program stands as an example of HTI strategy implementation. This program has led the Army in HTI organizational and policy development.</p> <p>The research identifies issues related to the Army's HTI policy and program implementation. Recommendations are provided to enhance the strategy's evolution in the Army's and the Department of the Defense's procurement structures. The study concludes the HTI strategy is a viable method for modernizing the force with significant advantages to be realized from its implementation.</p>				
14. SUBJECT TERMS Horizontal Technology Integration, HTI, Second-Generation, Forward-Looking, InfraRed			15. NUMBER OF PAGES 91	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

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by

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Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

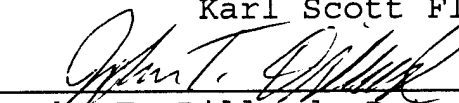
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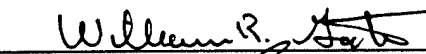
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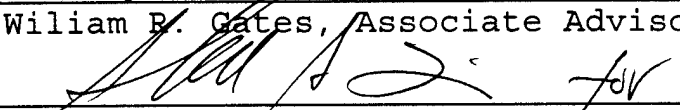
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ABSTRACT

This study was undertaken to analyze and document the Army's current policy and guidance governing the Horizontal Technology Integration (HTI) strategy. HTI increases common situational awareness and reduces Life Cycle Cost by simultaneously integrating multiple platforms with developing technologies. The Second-Generation Forward-Looking InfraRed HTI program stands as an example of HTI strategy implementation. This program has led the Army in HTI organizational and policy development.

The research identifies issues related to the Army's HTI policy and program implementation. Recommendations are provided to enhance the strategy's evolution in the Army's and the Department of the Defense's procurement structures. The study concludes the HTI strategy is a viable method for modernizing the force with significant advantages to be realized from its implementation.

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I. INTRODUCTION

A. PURPOSE

This thesis will explain the concept and implementation of Horizontal Technology Integration (HTI) policy in the Army's procurement process by analyzing the Second-Generation Forward-Looking Infrared Program (2nd Gen FLIR).

B. BACKGROUND

The Army's procurement budget continues to decline, forcing significant changes to service acquisition policy. One such change was adopting the HTI concept. HTI deviates from the Army's traditional vertical "stove pipe" development of mission area-specific solutions to a more horizontal, "integrated battlefield" method. When a component is identified as an HTI item, it will be universally developed and integrated on several platforms with minimal modifications.

Several organizations, including Training and Doctrine Command (TRADOC) Battle Labs, certify potential HTI components. This certification process lays the foundation for multiple systems integration. Only three programs have met HTI criteria to date, they are the Battlefield Combat Identification System (BCIS), Digitization of the Battlefield, and 2nd Gen FLIR. Upon completion, each program will provide the Army with a pre-integrated component or sub-system.

The HTI concept has been around for a while in the form of "standardization" and "common module" subcomponents, but misalignment of funding, schedules, and requirements have precluded complete implementation. Recent technical advances and funding constraints have caused a more earnest attempt as "official policy" for the Army to enact. Army HTI policy needs to be comprehensive in scope to provide platform integrating Program Managers (PMs) the guidance they need to successfully implement the HTI component. Some HTI programs may step across service boundaries to permit integration on

other than Army systems. Therefore, Army policy must potentially expand to include interservice actions.

Since the policy is still in its infancy, research is needed to improve the existing process. To underscore its importance, an HTI operations cell was recently organized and staffed. It provides insight into HTI policy and serves as the focal point for the interaction among platform and component PMs. Undoubtedly, the Army has accepted HTI as a viable procurement policy, providing additional cost reductions in future military procurement programs.

C. THESIS OBJECTIVES

The research objective is to analyze and explain HTI policy and its implementation in the Army's procurement process. Analyzing the 2nd Gen FLIR HTI program will help understand HTI policy and implementation procedures. By reviewing this program and feedback from personnel involved in the HTI process, realistic and viable recommendations will be made to improve HTI policy.

D. RESEARCH QUESTIONS

Primary Research Question: How is the Army implementing an HTI procurement strategy?

In support of the primary question, the following subsidiary questions were established:

1. What is HTI and what HTI procurement policy has the Army adopted?
2. What is the HTI process from development to production?
3. What are the responsibilities of PMs involved in HTI, specifically HTI component PMs and platform PMs?
4. What changes to the Army's existing HTI policy will improve the overall HTI procurement process?

5. What is 2nd Gen FLIR? How, why, and when did the 2nd Gen FLIR become an HTI program? What is its current acquisition strategy, specifically HTI requirements?

E. RESEARCH SCOPE, LIMITATIONS, AND ASSUMPTIONS

This thesis will focus on the current Army HTI policy and implementation procedures. Studying a specific HTI item will emphasize the real world problems and procedures occurring in the HTI acquisition process. The 2nd Gen FLIR procurement program is the case study used in this thesis research.

The principal limitation of this thesis is the program's infancy and lack of published materials or analytical data. HTI is one of the most recent changes to the Army's acquisition process. As a result, several of the literature resources used in this thesis are draft documents. In general, the concepts referenced in this thesis are accepted as endorsed policy. However, this thesis does not represent the official policy of the Department of the Army (DA) or any organization referenced herein.

Throughout this study, it is assumed that the reader is familiar with the Army's procurement process. It is further assumed that the reader is familiar with basic Army and acquisition terminology. Appendix A provides a list of acronyms used throughout this thesis.

F. RESEARCH METHODOLOGY

This research consisted of an in-depth literature review and interviews with DA civilian and military personnel. The literature review included HTI concept papers, briefing packets, meeting minutes, and memoranda. 2nd Gen FLIR program documentation and briefing packets, and other pertinent written materials were also referenced.

Research travel was conducted to PM 2nd Gen FLIR (in Ft. Belvoir, Virginia), offices of the Deputy Chief of Staff for Operations and Plans (DCSOPS) (at the Pentagon, Washington, D.C.), and PM Abrams Tank System (PM M1) and PM Armored

Systems Integration (PM ASI) (in Warren, Michigan) for personal interviews and review of on-site references.

G. ACRONYMS

See Appendix.

H. ORGANIZATION

This thesis consists of the following five chapters:

Chapter I - Introduction: this chapter provides the background, objectives, scope, limitations, methodology, and organization of this thesis.

Chapter II - HTI Background: this chapter provides the DA's HTI concept and implementation policy. It presents a general description of HTI policy for practical application to the 2nd Gen FLIR program.

Chapter III - 2nd Gen FLIR Case Study: this chapter analyzes the 2nd Gen FLIR program. It includes a chronological program summary, the program's Acquisition Plan and Strategy, and identifies the 2nd Gen FLIR PM's responsibilities and integration considerations.

Chapter IV - Issues and Analysis: this chapter evaluates recommendations and lessons learned from the 2nd Gen FLIR HTI program and HTI implementation.

Chapter V - Conclusions and Recommendations: this chapter summarizes the results of the research and presents conclusions and recommendations for further research for the HTI program and related areas.

II. HTI BACKGROUND

A. INTRODUCTION

This chapter will define HTI and describe how HTI developed into one of the Army's prime modernization strategies. It will describe HTI's concept of operation to include its three enabling strategies, the process for implementation, and its management organization. Finally, this chapter discusses some of the strategy's general advantages and disadvantages.

B. DEFINITION

HTI is defined as the application of common enabling technologies across multiple systems to improve the force's warfighting capability. [Ref. 1]

HTI is a departure from the traditional "Stovepipe" processes that have lost utility in today's austere fiscal environment. HTI simultaneously integrates dissimilar weapons systems that fight together as units with common technology, through new acquisitions, system component upgrades, or product improvements. The HTI process, if implemented effectively, results in warfighters "seeing the same battlefield" while enjoying "common situational awareness." [Ref. 2]

C. HISTORY

Following the Persian Gulf War and the collapse of the Soviet Union, the Army's leadership recognized the need to modernize today's Army to prepare for the conflicts of tomorrow. General Gordon R. Sullivan, Chief of Staff of the Army (CSA), introduced his strategy to carry the Army's modernization efforts to the year 2010. The strategy is aptly called, "The Force XXI Campaign Plan" (Figure 1). [Ref. 3]

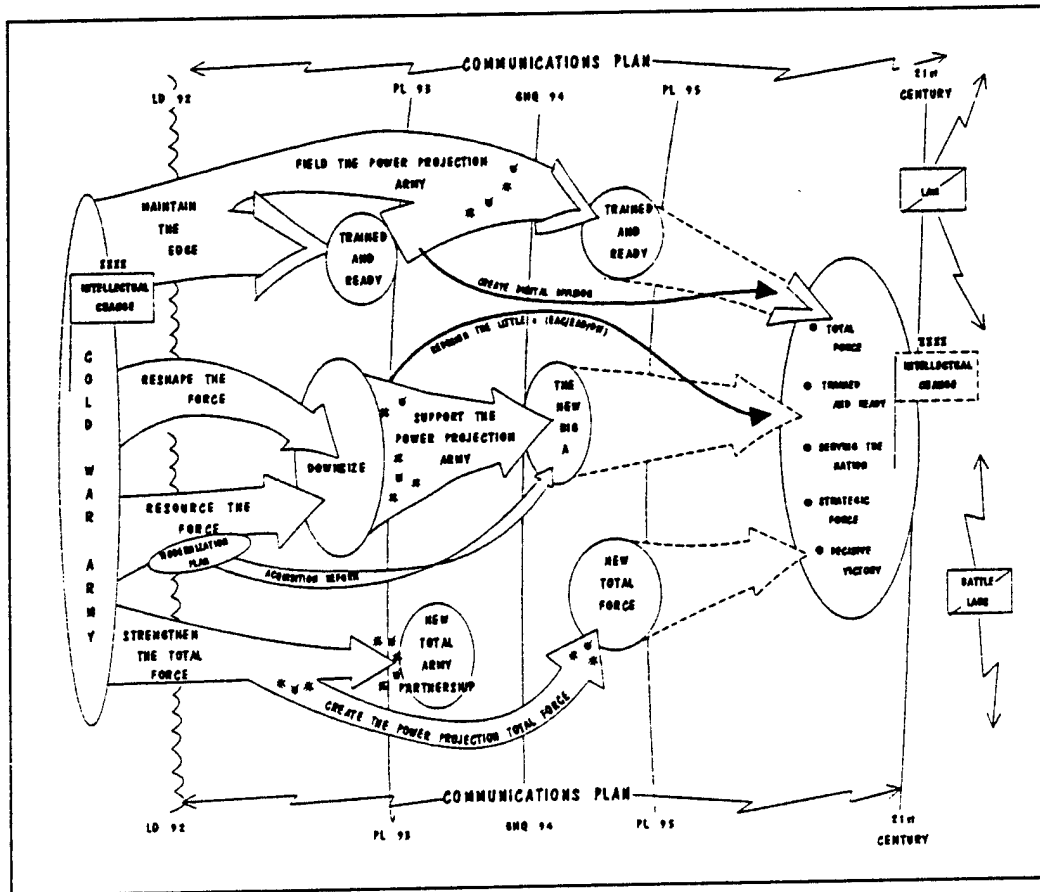


Figure 1. Force XXI Campaign Plan

The essence of this plan's equipment modernization effort is to break free of old concepts by using command and control technology to leverage the power of the information age. General Sullivan stated, "We have rescoped our modernization vision to improve our ability to acquire and assimilate Post-Industrial technology. Modernization is no longer about systems: it is about capabilities." [Ref. 4]

Although the term HTI as explained in the Army's modernization strategy, is new, the foundation of the concept itself is not. As early as 1976, common technological capabilities through modernization were being explored in a Forward Looking InfraRed (FLIR) system. Common modules, as defined later, are the foundation of the of the HTI concept. The 1976 FLIR design manual states "The modular approach offers performance

and configuration control comparable with custom FLIR designs, but promises significantly reduced cost through reliance on common equipment." [Ref. 5] These benefits, described in the 1976 FLIR manual, mirror some of the benefits expected from today's HTI concept. Unfortunately, common modules didn't survive for various political and technical reasons. Today's HTI strategy shouldn't suffer the same fate because of reduced new-start program funding and emphasis from high level Army officials.

Common modules have been used at basic technology levels for many years. Several systems have integrated common items such as heaters, seats, and stop light housings. However, these components do not represent the high technology development and commonality directed by the CSA.

There are a number of recent Army modernization programs employing the HTI initiative at the integrated and advanced technological level envisioned in the Force XXI Campaign Plan. For example, some OH-58D, UH-60, and AH-64 aircraft have integrated frequency-hopping communications (SINGARS) and navigation (Global Positioning) systems, along with common aircraft survivability equipment, such as radar jammers and warning receivers. None of these examples employed the HTI strategy and implementation measures as outlined in this thesis.

D. CONCEPT

The Army modernization vision supports the Army's goal of Land Force Dominance to enable decisive victory in any strategic or tactical environment. To achieve this, the Army must meet five objectives: [Ref. 6]

1. Project and sustain the force
2. Protect the force
3. Win the information war
4. Conduct precision strikes
5. Dominate the maneuver

To operate effectively in future environments, the Army must function as a totally integrated team. That integrated team will be one in which Combined Arms forces share the same common picture of the battlefield so they can communicate and target in real time. This requires integrating systems and capabilities across multiple programs and mission areas. HTI is the modernization strategy designed to facilitate the transition to a more dynamic and integrated fighting force.

Further accelerating the Army's acceptance of the HTI concept is the austere fiscal environment in which DoD now operates. The RDA budget for the 1990's is 22% less than the budget in the 1970's. [Ref. 7] As the budget becomes even more constrained, and the Army continues to downsize, alternatives to current procurement practices must be researched. Traditional methods of developing and procuring material and upgrading weapon systems have become less cost effective. [Ref. 8] The HTI strategy helps the Army optimize its modernization funds, while simultaneously integrating the total force.

HTI is a deviation from the traditional method of vertical procurement. As a new way of doing business, it reevaluates current methodologies. Convincing the acquisition work force that HTI is an acceptable method is one of the most significant barriers the program must overcome. However, with continued emphasis and direction from the Army's top leaders the HTI strategy will remain a viable modernization program. This shift in the procurement paradigm will be explored further in the analysis chapter of this thesis (Chapter IV).

Currently, there are three separate methodologies envisioned for applying the HTI strategy to the force. Each facilitates developing a new system or upgrading systems already in the Army's inventory. The three methods are: [Ref. 9]

1. Combining existing systems to form a new system or capability. An example of this method is merging the HMMWV, Stinger, and an advanced FLIR to create Avenger.

2. Combining technology already existing and embedded in one or more dissimilar systems. An example is the fully interoperable digitization communication system developed from digital systems existing in the M1A2 Abrams, Aviation, and fire support weapon systems.

3. Directly inserting emerging technologies into existing systems horizontally across the force. An example is the Battlefield Combat Identification System transponder. Although completely different in their approach, each method provides the horizontal integration base necessary to be HTI.

Discussions on HTI commonly reference the A-Kit and B-Kit (Figure 2). The A-Kit is the system (platform) unique hardware designed to integrate the common subsystem. The B-Kit is the common subsystem (module) developed to be simultaneously integrated into several platforms. Horizontally integrating the B-Kit into numerous Army systems via the A-Kit represents the third methodology mentioned above. This integration terminology is indicative of today's HTI strategy.

E. ENABLING STRATEGIES

The Army will identify enabling strategies that improve and enhance force capability. These enabling strategies will guide HTI, so they must be clearly defined and agreed upon up front. Currently, "Own the Night," "Combat Identification,"

Kit Concept

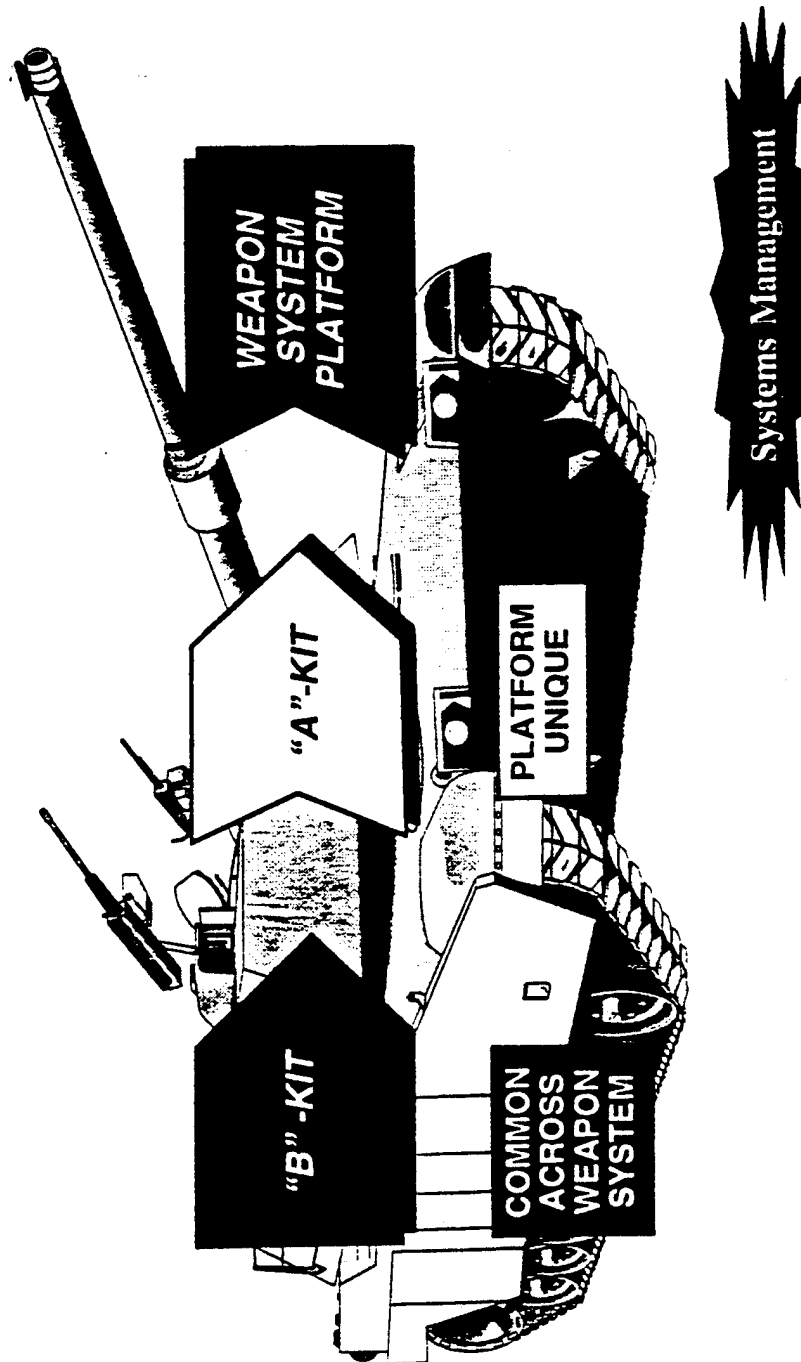


Figure 2. HTI A&B Kit Concept

and "Battlefield Digitization" are selected enabling strategies that enhance warfighting capabilities (Figure 3). [Ref. 10]

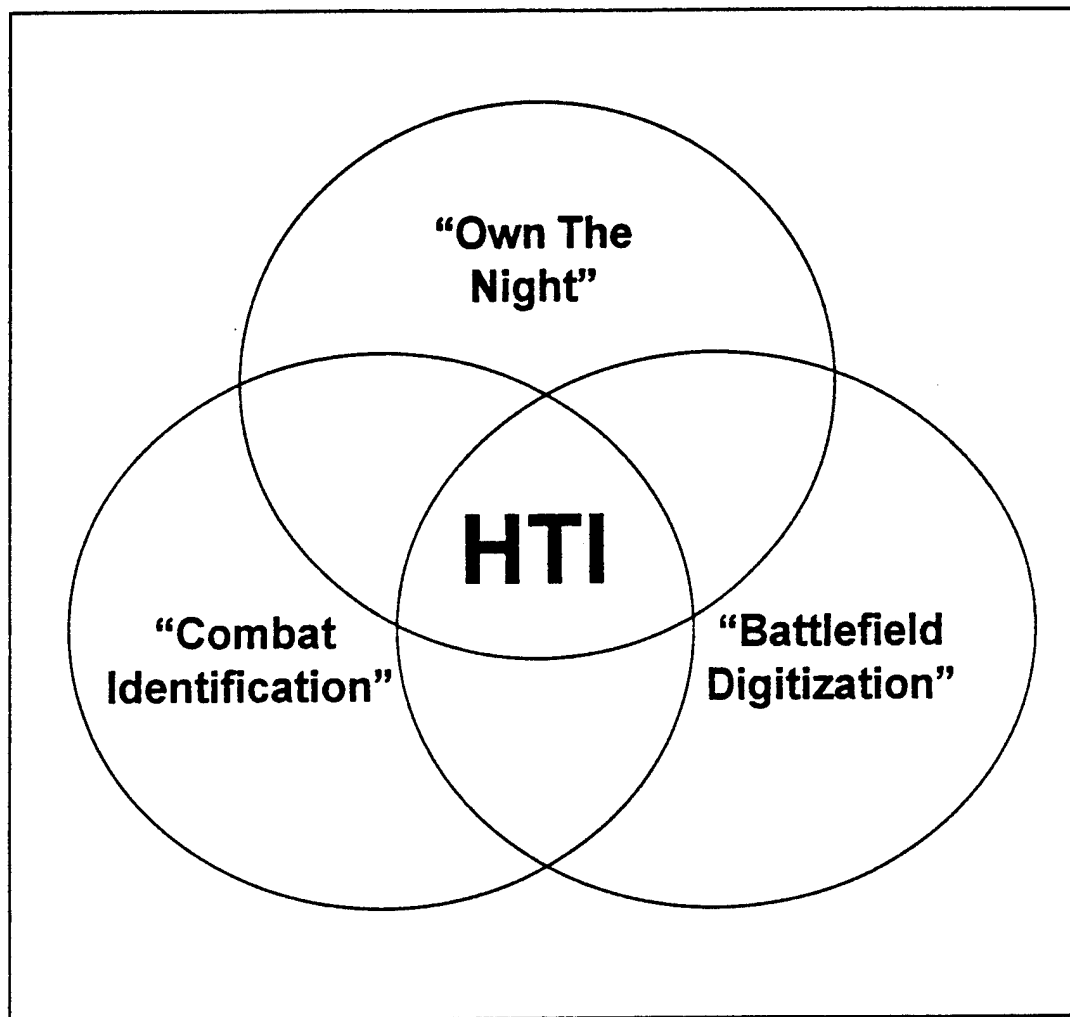


Figure 3. HTI Enabling Strategies

1. "Own the Night"

This ensures the capability to conduct continuous, around-the-clock operations to achieve tactical surprise and maintain momentum. Second Generation Forward Looking Infra-Red (2nd Gen FLIR) technology, the "Own the Night" strategy's

primary program, has matured and can be inserted into aircraft, tanks, Bradley Fighting Vehicles, and command and control vehicles. 2nd Gen FLIR increases range, fields-of-view, and resolution compared to previous thermal imaging systems. [Ref. 11]

2. "Battlefield Combat Identification"

Enhancing both situational awareness and the target identification process will reduce the risk of fratricide. Target identification allows the warfighter to properly distinguish friend from foe throughout the target engagement process. Situational awareness helps warfighters know their location and disposition on the battlefield relative to the other combatants. Milli-Meter Wave (MMW) technology provides a solution to the near-term challenge. [Ref. 11]

3. "Battlefield Synchronization at Brigade and Below"-- Digitization (Third Wave Battle Command)

Rapid exchange of information through high-speed digital networks and data transfer systems is an absolute requirement for Army modernization. Simply stated, this gets the right information to the right warfighter at the right time. Opportunities to exploit digital technology are being incorporated into the material acquisition process. This enabling strategy has been referred to as "digitization." As a central element of the Army's modernization vision, digitization must provide the architecture for the integrated battlefield. Advanced sensors, very high speed digital computer processors, fiber-optic networks, and state-of-the-art transmitters and receivers can develop and rapidly transfer battlefield information in digital format. This provides warfighters common situational awareness while increasing the tempo and lethality of combat operations. Success of the digitization effort requires developing common software standards, formats, and protocols. These critical elements will enable system-to-system and computer-to-computer linkages resulting in real-time awareness on the battlefield. [Ref. 11]

F. MANAGEMENT STRUCTURE

New strategies, like HTI, that are both innovative and complex require a well-planned management structure. An "Umbrella" structure that effectively links the acquisition, material development, combat development, and user communities is critical. On the basis of this complex management requirement, the Department of the Army (DA) established a General Officer Working Group (GOWG) as the central authority for HTI initiatives and programs. The GOWG membership includes HQDA representatives from Deputy Chief of Staff for Operations and Plans (DCSOPS), Assistant Secretary of the Army (Research, Development, and Acquisition) (ASA RDA), Program Analysis and Evaluation (PA&E), Assistant Secretary of the Army (Force Modernization) (ASA FM) and Director of Information Systems for Command, Control, Communications, and Computers (DISC 4), along with Training and Doctrine Command (TRADOC) and Army Material Command (AMC) representatives. [Ref.12] This distinguished group establishes the high-level commitment needed to provide specific intent and guidance, assistance in the resolution of critical issues, and strategic management oversight. The GOWG is absolutely imperative if the HTI process is to break down existing bureaucratic barriers ingrained in the traditional vertical development process.

HTI management structure below the GOWG will be built around existing organizations, teams, and structures. Utilizing the established structure allows immediate activity in the three enabling strategies. It also provides a well established and proven audit trail for managers to follow in the development of their HTI program.

G. IMPLEMENTING HTI

The HTI implementation process will comply with existing Federal Acquisition Regulations (FAR), and Army procurement regulations DoD 5000.1, 5000.2, and AR 70-1. This provides

each Program Manager (PM) with the procedural guidelines necessary to prepare for each milestone decision.

Implementing HTI is a methodical development process involving several systemic acquisition processes, including the life-cycle model and the prioritization process. The following recommended method for implementing of a given HTI strategy serves as a framework that allows the strategy to evolve.

1. Battle Labs and Louisiana Maneuvers

Much like any procurement program, the HTI process begins with the operational requirements process. Candidate HTI enabling strategies originate in the same manner as other requirements within the user community: through Army schools and centers, Louisiana Maneuvers, or Battle Labs. Since the Louisiana Maneuvers and Battle Labs are recently created organizations, and because they are an integral part of the HTI process, a brief description is warranted.

a. Louisiana Maneuvers

Louisiana Maneuvers provides a means for senior leadership to focus on critical growth issues like HTI technology, make policy decisions, and guide the allocation of resources. Any issue selected for scrutiny under the Louisiana Maneuvers program is assigned a major command as proponent and an element of the Army staff as sponsor. Together, they examine the issue using simulations coupled with actual troop formations at existing training facilities, to formulate a recommendation for the Louisiana Maneuvers Board of Directors and the CSA. [Ref. 13] Using Louisiana Maneuvers in the earliest stages of the HTI process gives the Army an economical test bed to confirm the feasibility and the advantages and disadvantages of integrating specific technology across the force.

b. Battle Labs

TRADOC has organized six Battle Labs to identify, develop, and experiment with new warfighting concepts and

capabilities. Battle Labs are designed to: facilitate the flow of new ideas; examine battlefield dynamics and the impact capabilities offered by new technologies have on the future battlefield; and integrate promising concepts across the Army. The six Battle Labs (Figure 4) and their fundamental missions are: [Ref. 14]

1. Early Entry Lethality and Survivability Battle Lab - Study power projection and the early entry force concept.
2. Depth and Simultaneous Attack Battle Lab - Study the application of combat power throughout the depth and space of the battlefield.
3. Mounted Battle Space Battle Lab - Study capabilities for engaging the enemy outside his range, both day and night.
4. Dismounted Battle Space Battle Lab - Study capabilities for engaging the enemy outside his range, both day and night.
5. Battle Command Battle Lab - Study aspects of combat and force development required for commanding the combined arms force.
6. Combat Service Support Battle Lab - Study aspects of logistical support needed to sustain the combined arms force on tomorrow's battlefield.

Battle Labs provide a network which electronically and intellectually link the Battle Labs, TRADOC schools, R&D community, academia, and other national agencies. Experimentation by the Battle Labs screens potential HTI technologies and their application horizontally across the force. TRADOC policy is to assign a specific Battle Lab the mission of fostering the initial development of relevant HTI enabling strategies.

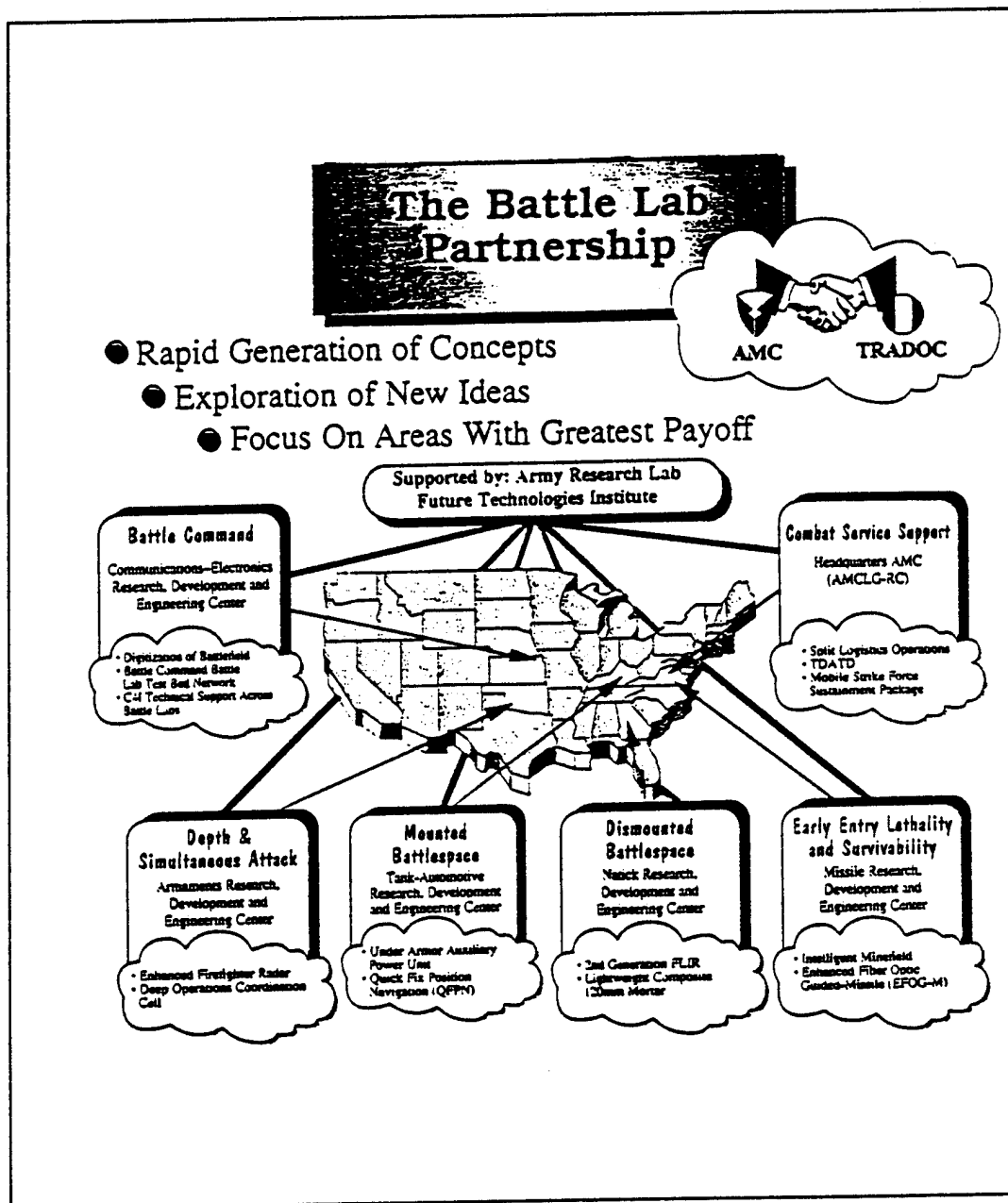


Figure 4. Battle Labs

Once the technology emerges from the Battle Labs, Louisiana Maneuvers, or other organizations, TRADOC, under the direction of the HQDA GOWG, prepares an HTI proposal and presents it to the VCSA and ASA(RDA). VCSA and ASA(RDA) review the proposal, which includes the Mission Needs

Statement and supporting documents, before declaring the technology an HTI initiative or enabling strategy.

2. Special Task Force (STF)

If the proposed HTI strategy is approved by the VCSA and ASA(RDA), a Special Task Force or appropriate management structure is chartered by the Vice Chief of Staff of the Army (VCSA) to develop a master plan outlining the scope of the effort. The STF should maintain a staff of approximately 30 personnel from TRADOC, AMC, and PEO/PM, that are resourced directly through HQDA. Recommended STF organizations will include the following (Figure 5):

- a. User Advisory Group: Contains Two-Star level representatives from TRADOC schools, PEOs, and other communities, such as Test and Evaluation Command (TECOM). Provide critical top-level insight, review, and guidance to the STF and STF Chairman.

- b. STF/User Advisory Group Chairman: General Officer or Senior Executive Service (SES) who is the senior manager of the STF and coordinates and directs the User Advisory Group and the STF.

- c. Special technical Advisor: Top specialist in the particular HTI technology being developed.

- d. Deputy for Requirements and Deputy for Acquisitions: Intermediate level management (O6 level) responsible for executing specific requirements and guidance received from the STF Chairman and User Advisory Group.

- e. Operational Suitability Team, Technical Team, Procurement Team, and Programmatic Team: Teams organized from various organizations, such as TRADOC and PEOs, to produce directed requirements.

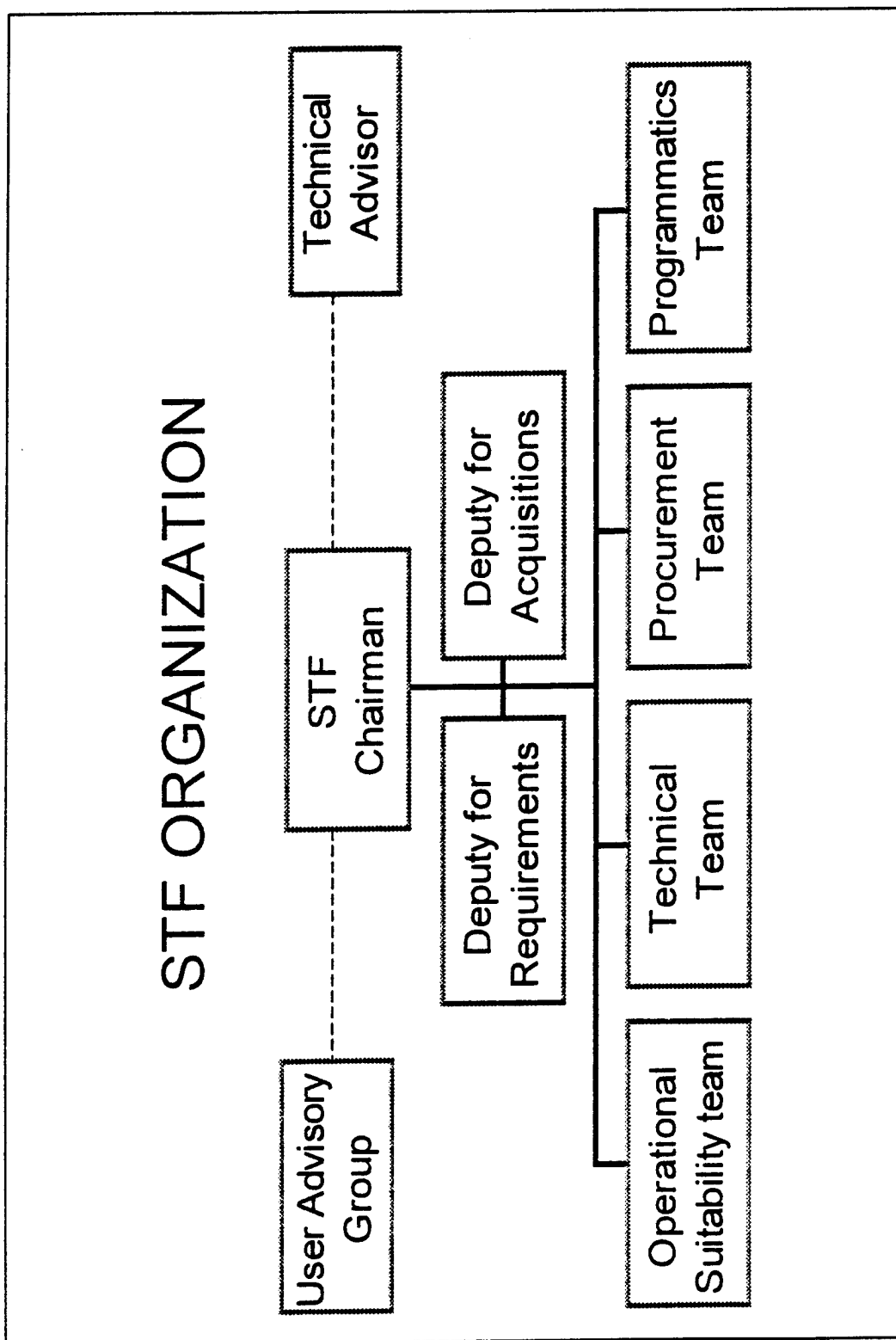


Figure 5. Suggested Special Task Force Organization

The STF continues until the Statement of Work (SOW) of the Request for Proposal (RFP) is written and Milestone I is completed. During this time, the STF produces the technical assessment, trade-off analysis, best technology approach, Operational Requirement Document, Management Development Execution Package (MDEP) proposal, prioritized systems/force packages, and other management recommendations. [Ref. 15] If the Milestone I decision establishes the HTI strategy as a formal acquisition program, the STF is dissolved and the designated PEO/PM assumes responsibility for the program.

Thus far, each of the three enabling strategies have had an STF chartered by DA.

3. Program Management

In traditional weapon system acquisitions, a PEO/PM is responsible for developing and applying a specific technology to individual systems. However, when applying technology across multiple systems, a different approach is required. There are two Program Management alternatives recommended for an HTI strategy. [Ref. 9]

a. For complex and multiple system HTI strategies, a separate PM under the control of an established PEO will manage the common technology (B-Kit) development. System PMs are responsible for integrating the specific technology into their system (A-Kit).

b. For less complex integration or limited system requirements, a single PM will be responsible for technology acquisition and integration in appropriate systems (A&B-Kits). This management structure may be more appropriate when all systems to be integrated fall under the responsibility of one PEO.

PEOs and PMs will utilize established acquisition management procedures in HTI programs. ASA(RDA) will ensure the technology insertion is completely synchronized through management oversight of the respective PEOs and PMs. PEO/PM for both the common technologies and receiving systems manage

HTI as a part of planned systems improvements and milestone upgrades. They are responsible for ensuring the weapon systems acquisition strategy and acquisition plan are designed to incorporate a horizontal approach. [Ref. 12]

4. PM Armored Systems Integration (PM ASI)

Recognizing the Army's emphasis on the HTI concept, PEO Armored Systems Modernization (PEO ASM) organized an HTI Directorate under the control of an Armor officer (O6). Effective FY 95, the HTI Directorate became a new Program Management office called PM ASI. PM ASI serves as the HTI initiatives focal point for PEO ASM and several other external organizations touched by HTI strategies. Their current HTI mission and function statements follow: [Ref. 16]

MISSION

- a. Provide the PEO ASM with an independent engineering staff.
- b. Apply common technologies across multiple systems to improve the warfighting capability of the force.
- c. Provide simultaneous integration and fielding of technology into different types of weapon systems that fight together as units or task forces, thereby improving the force.
- d. Apply a process that supports an integrated battlefield architecture.
- e. Allow weapon systems such as the M1A2, M2A3, AH-64C/D, and others, to rapidly see, acquire, and engage threats while sharing the same information with equal clarity, using advanced technologies and digital communications.
- f. Provide independent technical advice and recommendations on issues concerning system and platform integration, engineering, quality, testing, configuration management, CALS, simulation, environmental issues, software, Gen II FLIR, Battlefield Synchronization and Digitization, ESLR/BCIS/IFF, GPS DAWV, and specifications, standards and technical data.
- g. Provide PEO policy in the above areas (paragraph f.).
- h. Serve as PEO level liaison with other PEOs, PMs, MCD, MSCs, and other government agencies and contractors.

FUNCTIONS

- a. Management - Understand how HTI is managed and provide the direction for implementing and managing and integrating technology/requirements across the force.
- b. Support - Provide technical support to the ASM PMs and support acquisition strategies to optimize the use of modernization funds.
- c. Oversight - Oversee all ASM PM technical activities to make sure integration of systems and capabilities occur across multiple programs and mission areas.
- d. Commonality - Perform necessary monitoring and coordination with appropriate PMs to assure that maximum commonality is achieved across ground vehicle systems.
- e. Spokesperson - Be the PEO spokesperson to contractors and government agencies for technical matters related to managed ground vehicle systems, i.e., act as PEO's "mouthpiece."
- f. Expertise - Be the source of expertise for HTI functions, i.e., ESLR/BCIS/IFF/Gen II FLIR/CALS/Battlefield Synchronization/Battlefield Digitization/GPS/DAWV/Environmental Engineering/Simulation/Specifications/Standards/Technical Data/etc.
- g. Efficiency - Manage resources including contractor resources and work with PMs to accomplish tasks in the most cost effective manner.
- h. Driving Force - Spearhead activities to improve system(s) technical performance, schedule, cost and benefits.
- i. Compliance/Enforcement - Be the PEO's "watchdog" to ensure that all offices are complying with the PEO's directions and philosophy.

PM ASI, however, is not an organization specifically directed or funded by DA. They have limited direct power, responsibility, and decision making within the Program Management structure of any HTI enabling strategy. However, PM ASI does have a necessary function in the HTI process. They provide a centralized and consolidated medium for PEO ASM PMs, HTI PMs and DA Staff to funnel a variety of horizontal integration issues.

5. HTI Program Resourcing Alternatives

If HTI is to succeed, HQDA must allocate sufficient funding for the individual enabling strategies. These strategies will be resourced through one of three alternative methods, depending upon the program's significance, complexity, and visibility. The three alternatives are [Ref. 9]:

a. Establish a single control Management Decision Package (MDEP) to consolidate all funds associated with the development, acquisition and application of each approved HTI. This assures centralized control and decentralized management. All funding for "A Kits" will be executed by receiving system PMs. All funding for "B Kits" will be executed by the PM managing the HTI item. No new Program Elements (PEs) or projects will be created except as necessary.

b. Place all funds related to the HTI development, acquisition, and application in a single PM controlled MDEP with subordinate, dedicated PEs and Special Study Numbers (SSNs). This assures centralized control and execution.

c. Place all funds in respective receiving system MDEP's modification lines. This assures decentralized control and execution of HTI.

Currently, the recommended method of resourcing HTI programs is by the first method described above. The MDEP is established to provide funding for both common government furnished hardware and for actually inserting and integrating the common hardware into the designated weapon systems. [Ref. 12] By providing alternative resourcing, DA has retained the flexibility to tailor the program based on the specific goals for each enabling strategy.

H. ADVANTAGES AND DISADVANTAGES

DA has envisioned HTI as an efficient method of affecting the modernization objectives outlined in the "Force XXI Campaign Plan." Several advantages and disadvantages have

been considered before DA decided to embrace HTI as one of the Army's principal methods of optimizing its modernization dollar. The following positive and negative arguments have been presented in documentation supporting HTI:

ADVANTAGES

1. Horizontal integration of technology across the Army provides an operational advantage to the force. The Army will realize increased capabilities creating fewer incidents of fratricide, reduced crew workload, shortened delays in decision-making and response time to critical actions, and better real-time communication between sensor and shooter. [Ref. 17]
2. HTI has the potential to significantly lower the overall life-cycle cost of systems being integrated, by focusing engineering development on the HTI subsystem. The savings in life-cycle cost will be possible because of the following benefits: [Ref. 18]
 - a. Technology in the form of common modules or subsystems integrated in multiple platforms reduces cost through economy-of-scale purchases.
 - b. Repair parts and spares will be common for HTI subsystems allowing economies-of-scale for logistical support.
 - c. Test requirements during the HTI subsystem development will be reduced and streamlined. This consolidated testing reduces the risk of schedule slips for individual systems. However, it also makes every system dependent on the HTI test schedule, which increases the impact of one schedule slip.
 - d. Planned product improvements and future upgrades are facilitated by common subsystems.
 - e. Fielding common subsystems reduces operational and support costs and more efficiently uses manpower (especially maintenance personnel) by concentrating critical skills towards one major effort as opposed to several.
3. HTI helps ensure that the Defense Industrial Base is kept "warm" and productive, while maintaining its technological edge.

As lucrative as these advantages seem, there remains potential disadvantages that require careful consideration. Possible drawbacks to the HTI strategy include: [Ref. 11]

DISADVANTAGES

1. Realigning program schedules, changing technical approaches and altering funding strategies to incorporate technology or implement product improvements could increase up-front costs.
2. Older generation systems may require major modifications before they can accept newer-generation technology.
3. Cost, schedule, and performance risks may be greater when trying to integrate compatible or common subsystems with dissimilar weapon systems.
4. Funding management, administrative processes, and developing operational requirements may be increasingly difficult when attempting to incorporate technology into multiple weapon systems.
5. Even though the Industrial Base is kept "warm" as stated earlier, the total number of specific producers may be reduced.

This list of major advantages and disadvantages is not meant to be all inclusive. These and additional concerns are discussed in the analysis chapter (Chapter IV) of this thesis.

I. SUMMARY

The preceding sections of this chapter examined the background of the HTI strategy. First HTI was defined and a historical perspective presented. Next, the HTI concept was examined. This section discussed the enabling strategies, the management structure, implementation procedures, and briefly described the unique organizations involved in the HTI process. The chapter concluded with general advantages and disadvantages of the HTI strategy. The following chapter reviews the implementation of the "Own the Night" enabling strategy, specifically the 2nd Gen FLIR acquisition program.

III. SECOND GENERATION FORWARD LOOKING INFRARED CASE STUDY

A. INTRODUCTION

This chapter will detail the 2nd Gen FLIR Acquisition Program. The first section is an overview of 2nd GEN FLIR equipment and it's development history. The next section will discuss the program's Acquisition Plan. Finally, the program's acquisition and procurement strategy will be examined.

B. OVERVIEW OF 2ND GEN FLIR

As indicated in Chapter II, 2nd GEN FLIR provides the Army with a system that retains the force's "Night Fighting" advantage.

1. System Description

The 2nd GEN FLIR HTI Program utilizes the A&B-Kit HTI concept explained in Chapter II. Since it is representative of this program it is necessary to describe both kits, but this chapter emphasizes FLIR (B-Kit) procurement. A-Kit discussion will be limited to coordination and integration aspects for the B-Kit.

a. B-Kit

The 2nd GEN FLIR HTI module is based on developing a standard thermal sensor, the "NV-80" B-Kit. This FLIR module will be common for the Army's current and future target acquisition systems. The Kit (Figure 6) contains the core thermal imaging system components that are common to all vehicle platforms, such as the infrared focal plane array detector, cryogenic cooler, infrared optics, and associated electronics. [Ref. 19]

b. A-Kit

Platforms selected for B-Kit integration must be modified to accept the module, these modifications are called A-Kits. A-Kits include such items as head assembly, displays,

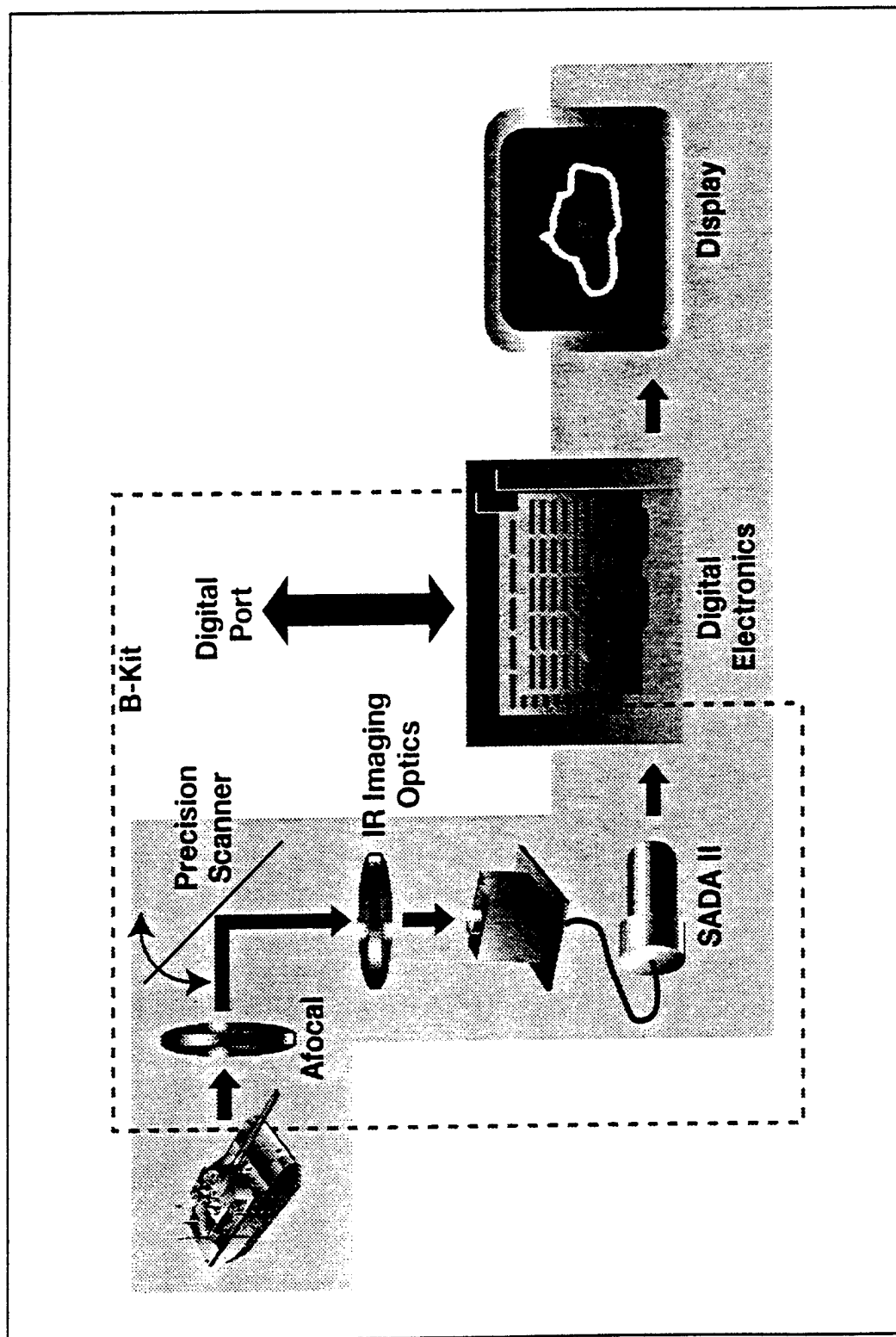


Figure 6. 2nd Gen FLIR B-Kit

interface electronics, brackets, and connectors. Each A-Kit is unique to the platform type involved. [Ref. 19]

2. Background

Following Operation Desert Storm, where the Army's night fighting capabilities were showcased, the CSA and TRADOC Commander recognized the importance of maintaining our technical edge in thermal technology. "Own the Night" became one of the Army's principle modernization objectives. Within this strategy 2nd GEN FLIR became the prime acquisition program to replace first generation thermal imaging technology. Almost simultaneously, the HTI modernization concept gained acceptance among senior Army officials. These two events, the need for a new generation thermal sight and a new modernization strategy, were merged to create the 2nd GEN FLIR HTI Program.

On 8 February 1993, DA officially established the 2nd GEN FLIR HTI STF. By 8 March 1993, the STF was co-located with the Dismounted Battlespace Battle Lab at Fort Benning, Georgia. Figure 7 is the 2nd Gen FLIR STF's organization chart.

The User Advisory Group (UAG) was co-chaired by the Commandant of the U.S. Army Infantry Center and School (who is also Director, Dismounted Battlespace Battle Lab) and the Deputy Assistant Secretary of the Army for Research and Technology. Participants from key user schools, development centers, program executive offices and PM offices, Army Material Systems Analysis Command and the TRADOC Analysis Command comprised the STF. [Ref. 20]

On 2 August 1993, five months after the STF was formed and virtually sequestered at Fort Benning, the TRADOC Commander approved the Operational Requirements Document (ORD). This was followed by DA approval on 9 December 1993, approximately four months later.

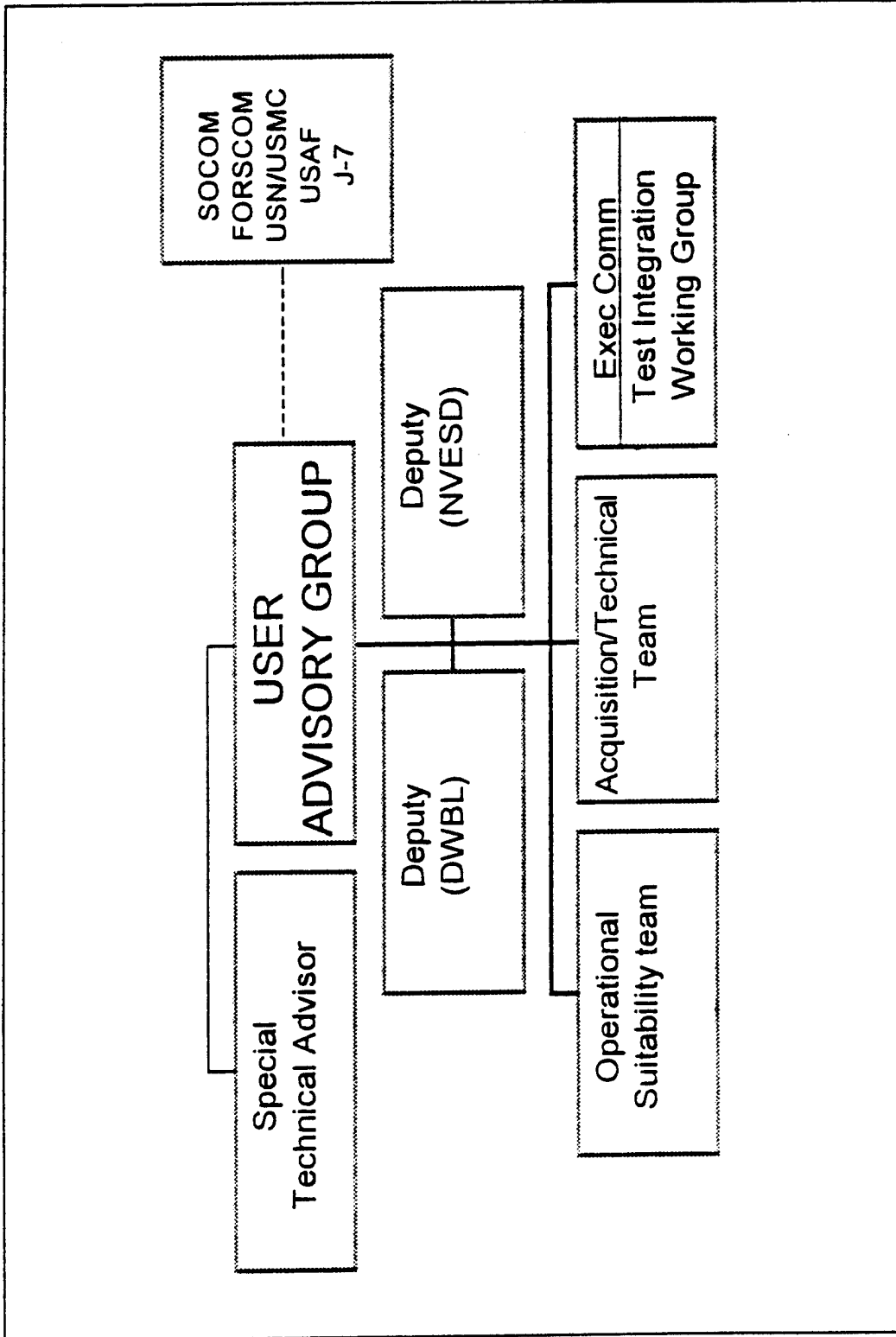


Figure 7. 2nd Gen FLIR STF Organization Chart

On 24 November 1993, the Army Acquisition Executive (AAE) designated 2nd GEN FLIR as an Acquisition Category II (ACAT II) program. Development responsibility was assigned to Program Executive Officer Intelligence and Electronic Warfare (PEO-IEW). Also a Product Manager for 2nd GEN FLIR (PM FLIR) was established and assigned under the Project Manager Night Vision Reconnaissance Surveillance and Target Acquisition (PM NV/RSTA) for overall program management within PEO-IEW. [Ref. 21]

Following the ACAT II decision and DA approval of the ORD, a competitive Request For Proposal (RFP) was issued in December 1993. One proposal was received from the team of Texas Instruments and Hughes Aircraft Co. The single proposal forced the proposal to be evaluated as a non-competitive procurement. [Ref. 22] The contract was let to the above mentioned team in July 1994.

In July 1994, the Milestone I/II decision was rendered by the Army Systems Acquisition Review Council (ASARC). This decision advanced 2nd GEN FLIR to the Engineering and Manufacturing Development (EMD) phase. A Low Rate Initial Production (LRIP) exit criteria was also approved, with a PEO level In-Progress Review (IPR) scheduled for FY 97. The IPR will evaluate whether the LRIP criteria have been satisfied. [Ref. 23]

The Milestone I/II decision culminated a streamlined process to propel 2nd GEN FLIR into the EMD phase. From February 1993 to July 1994, 2nd GEN FLIR moved from undefined requirements, through the RFP process to a successful ASARC review and decision, due primarily to the efforts of the STF and PM FLIR. This streamlined procedure may set a precedence for future HTI technology developments.

Following the ASARC review, the STF was formally dissolved and PM FLIR assumed full program responsibility. In December 1994, PM FLIR successfully completed the Preliminary

Design Review (PDR) for the 2nd GEN FLIR. The program is scheduled for the Critical Design Review in April 1995.

C. ACQUISITION PLAN

1. Statement of Need

The 2nd Gen FLIR will improve the Army's thermal imaging capability. This will increase target detection, recognition and identification capabilities during day, night or through smoke, fog, or other battlefield obscurants. [Ref. 24] Improving our visual capabilities allows Army forces to engage the enemy at extended ranges, while simultaneously reducing the number of fratricide incidents.

The 2nd Gen FLIR Program is one of the first procurement programs to fully embrace the Army's HTI strategy. The program will develop a common thermal module (B-Kit) that can be horizontally integrated into a variety of platforms. By procuring a common B Kit the Army will realize procurement economies of scale, reduced Life Cycle Cost, and common situational awareness.

The 2nd Gen FLIR Acquisition Plan includes all platforms identified in the ORD as improved FLIR candidates. However, only four platforms have currently been approved and funded for 2nd Gen FLIR integration: the Abrams Main Battle Tank (M1A2), Bradley Fighting Vehicle (M2A3), Armored Gun System (M8), and the Long Range Advanced Scout Surveillance System (LRAS3). [Ref. 24] Figure 8 presents all the platforms considered for 2nd Gen FLIR integration with the four funded platforms outlined.

2. Applicable Conditions

As stated in the background section, the program completed all requirements necessary to successfully complete the Milestone Decision Review I/II. Having received ASARC approval, the program is entering the EMD development phase.

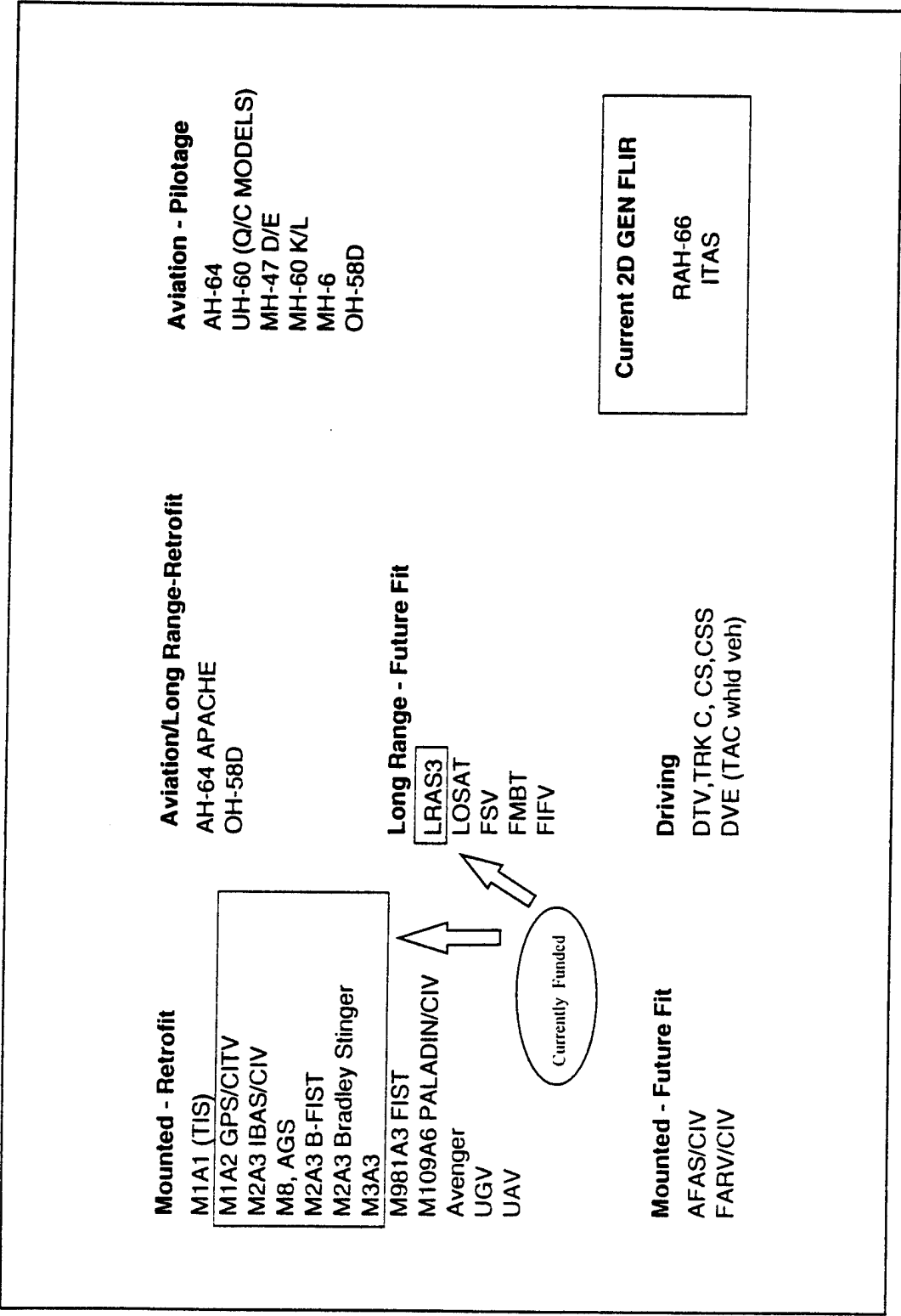


Figure 8. 2nd Gen FLIR Integration Platforms

3. Cost

a. **Life Cycle Cost:** The program's LCC estimate is for official use only. If specific information on the program's LCC estimate is required reference Annex B of the 2nd Gen FLIR Integrated Program Summary (IPS).

b. **Design-To-Cost:** A Design-to-Cost (DTC) requirement was included in the 2nd Gen FLIR RFP. The contract included an award fee to incentivize the contractor to meet the proposed Design-To-Unit-Production-Cost (DTUPC). The DTUPC began at EMD contract award and the Government will monitor it throughout the contract's life to assess the program's status. The DTUPC quantity will be the LRIP quantity of 400 units and a learning curve will be applied based on the contractor's experience with similar production efforts. [Ref. 24]

c. **Application of Should Cost:** A should cost analysis was not required or conducted for 2nd Gen FLIR EMD or LRIP.

4. Performance

The 2nd Gen FLIR provides an enhanced thermal imaging capability which doubles the current combat identification range. Specific improvements include a 55 percent increase in target acquisitions, a 44 percent increase in target hits, and improved identification capabilities in limited visibility. [Ref. 25] These improvements facilitate command and control, weapons effectiveness and situational awareness. Acquisition of the 2nd Gen FLIR maintains the Army's edge in night vision technology.

As an HTI acquisition strategy, the Army expects the B-Kit to provide several enhancements via low cost modular upgrade modifications: [Ref. 24]

1. Expandability of the digital buss in modular increments
2. Increased dynamic range to accommodate detector improvements
3. Increased frame rate

4. Increased electronic bandwidth
5. Increased processor throughput
6. Increased frame memory

The 2nd Gen FLIR HTI program is expected to facilitate ample future growth by providing interfaces for Pre-Planned Product Improvement (P3I), such as: [Ref. 24]

1. Automatic target cues or recognizers
2. Single/multiple target trackers
3. Image compression
4. Image feature enhancement and extraction
5. Image receipt/decompression
6. Freeze frame forward corrected transmission

Designing the 2nd Gen FLIR to facilitate future improvements in thermal capabilities enables the Army to steadily modify vehicular sights at reduced cost.

5. Risk

a. **Cost:** The cost risk is considered moderate. The Cost-Plus-Award-Fee (CPAF) EMD contract will help reduce cost uncertainties by motivating the contractor to control cost. [Ref. 24]

b. **Technical:** The program's technical risk is considered low to moderate. Since the thermal technology for the FLIR already exists, the assessment is low, but integrating the B-Kit on multiple platforms will moderately increase the program's overall risk. Technical risk is addressed by the program's producibility effort. [Ref. 24]

c. **Schedule Risk:** The schedule risk is moderate. A detailed B-Kit and A-Kit integration plan reduces the program's schedule risk. Successful joint planning and

coordination efforts are critical to minimizing the program's potential scheduling conflicts.

6. Program Schedule

The 2nd Gen FLIR program moved from initiation of the STF in February 1993 to the ASARC Milestone I/II decision in July 1994. The accelerated timeline was primarily the result of extensive modeling and simulation and diligent efforts by the 2nd Gen FLIR STF and Program Management Office (PMO). Figure 9 depicts PM FLIR's schedule for developing, producing, and integrating the 2nd Gen FLIR B-Kit/sight. [Ref. 25]

7. Budgeting and Funding

The Program Objective Memorandum's (POM) funding level for the 2nd Gen FLIR program is outlined in Figure 10. These funding levels are current as of January 1995. [Ref. 26] Funding levels for RDT&E and procurement are reflected for both A-Kit and B-Kit.

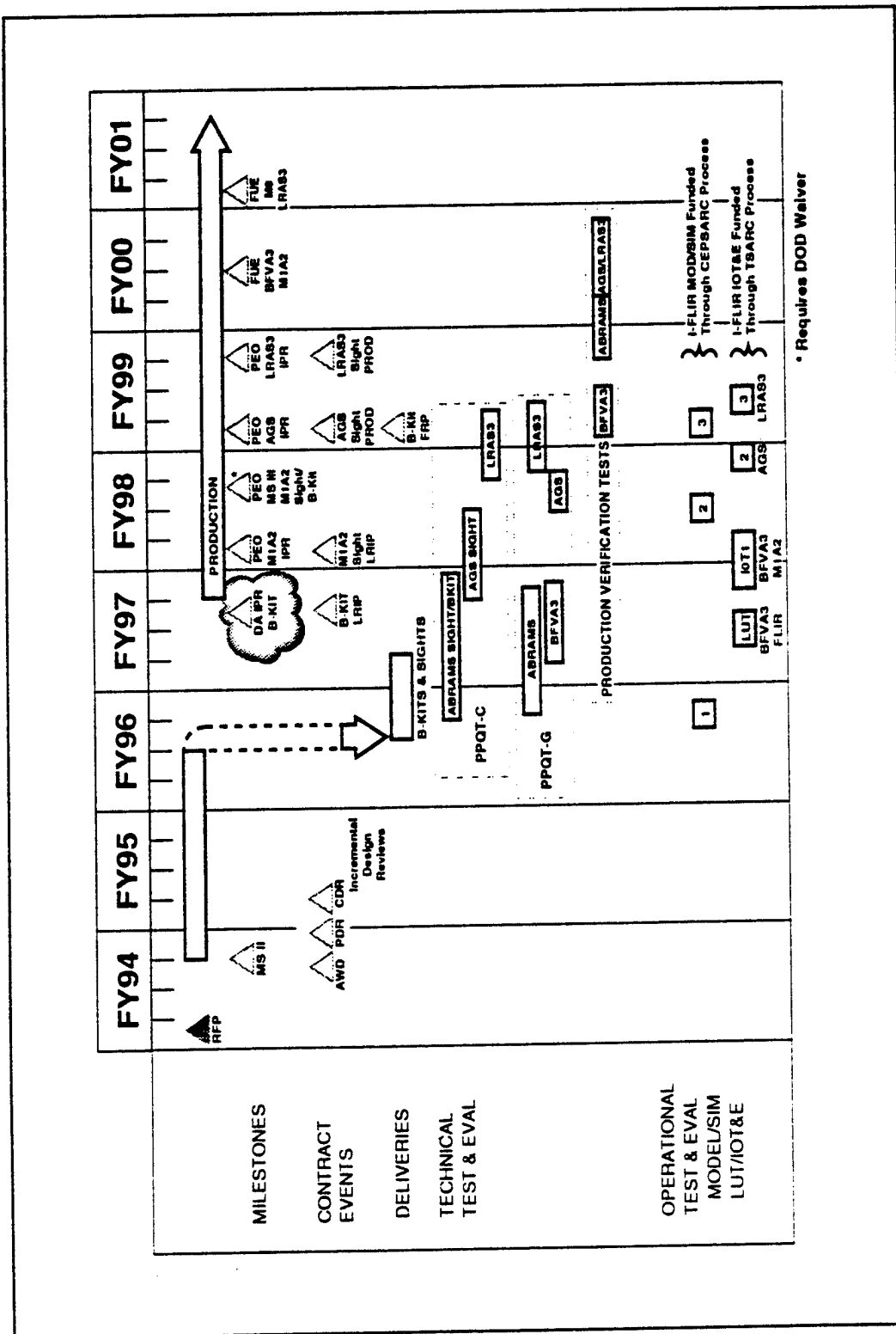
D. ACQUISITION STRATEGY

1. Program Requirements

The 2nd Gen FLIR B-Kit will be procured and integrated horizontally into the M1A2, M2A3, M8, and LRAS3. A total of 85 B-Kits and/or sights will be produced for system integration and qualification in the EMD phase. (Note that the program differentiates between sight systems (M1A2 and M8) and B-Kits (M2A3 and LRAS3), but the 2nd Gen FLIR technology is common for all platforms.) The A-Kit will be engineered concurrently to ensure the FLIR's desired form, fit, and function is achieved. [Ref. 22]

2. Program Management

The HTI methodology in the 2nd Gen FLIR program requires clearly separating management responsibilities between the B-Kit and platform (A-Kit) program offices. The two controlling authorities, PEO IEW (B-Kit) and PEO ASM (A-Kit), signed a Memorandum of Agreement (MOA) on 5 May 1994 defining the management and technical interfaces needed to control cost,



	94	95	96	97	98	99	00	01
RDTE								
B - Kit	14.0	24.9	29.4	23.4	4.0			
A - Kit								
- M1A2		11.7	22.9	38.8	2.8			
- AGS			14.7	9.1	1.6			
- LRAS3				3.0	7.3	4.6		
Procurement								
B - Kit								
- M1 Abrams (Mod)					33.0	31.2	27.5	10.5
- Abrams								25.2
- Upgrade Prog.								
- M2A3				20.6	22.2	29.4	44.6	31.7
- AGS					6.9	15.6	11.5	
- LRAS3						6.5	17.2	23.6
- Training Devices			3.6					
A-Kit								
- M1 Abrams (Mod)							5.2	28.2
- Abrams				5.7	29.4	30.3	31.0	32.1
- Upgrade Prog.								
- AGS					5.2	41.2	16.1	
- LRAS3						12.8	20.6	25.9

Figure 10. 2nd Gen FLIR POM Funding Levels

schedule, and performance risk associated with 2nd Gen FLIR integration requirements. The management responsibilities are outlined as follows: [Ref. 27]

a. PEO IEW/PM FLIR is responsible for the B-Kit development and test and for supporting production and integration of the B-Kit. PM FLIR, through a contract with Texas Instruments and Hughes, is also responsible for developing and testing the 2nd Gen FLIR for the M1A2 and the M8.

b. PEO ASM/PM M1A2 is responsible for A-Kit development, test, and production and for integrating and deploying the 2nd Gen FLIR in the M1A2.

c. PEO ASM/PM M2A3 will use the B-Kit in its M2A3 development, test, and production.

d. PEO ASM/PM AGS is responsible for A-Kit development, test, and production and for integrating and deploying the 2nd Gen FLIR in the M8.

e. PEO IEW/PM-NV/RSTA will use the B-Kit in its LRAS3 development, test, and production.

The PEOs also agreed to establishing Team FLIR to provide a structured organization for resolving 2nd Gen FLIR integration and fielding issues. Team FLIR's proposed structure closely resembles the 2nd Gen FLIR's STF. The proposed organization is divided into three distinct groups: the Executive Steering Committee, Management working Group, and Process Action teams. The group's responsibilities and composition are: [Ref. 28]

a. **Executive Steering Committee (ESC):** The committee will be co-chaired by the Commanding General United States Army Infantry Center (USAIC), DCSOPS-FD, and ASA (RDA) for Systems Management. The committee will include two star level representatives from PEOs, the user community (TRADOC), and associated DA staff agencies. The ESC provides senior Army oversight and direction to the Management Working Group as necessary to completely integrate and field the 2nd Gen FLIR.

b. **Management Working Group (MWG):** The group will be co-chaired by PM NV/RSTA, Chief of the Dismounted Battlespace Battle Lab, and PM ASI. The group will include representatives from PMOs, TRADOC, Test and Evaluation Command (TECOM), and associated DA staff agencies. They are primarily responsible for team integration, interface management and affordability. They will also provide guidance to the Process Action Teams and recommendations to the ESC.

c. **Process Action Teams (PATs):** PATs will be established on an as needed basis and composition adjusted appropriately. PM FLIR will be co-team leader of each PAT. PAT's resolve issues presented by the MWG.

Team FLIR's composition will be adjusted or modified as needed. The team will operate until formally dissolved by the ESC.

3. Quantities to be Procured

The 2nd Gen FLIR procurement strategy is segregated into three separate phases, EMD, LRIP, and Full Rate Production (FRP). The EMD phase requires developing 35 sights and 50 B-Kits. Development will be contracted through five concurrent contracts: one for developing the items listed below; and four individual contracts for developing the platform unique A-Kit, performing sight qualification, and conducting vehicle performance testing.

a. **EMD Phase:** The following list presents a platform specific list of the 53 B-Kits/sights to be produced in the EMD phase. [Ref. 22]

Number of Units	System/Requirement
13	Thermal Imaging System (TIS) for M1A2 GPS
13	M1A2 Commanders Independent Thermal Viewer (CITV)
22	B-Kits for M2A3 Improved Bradley Acquisition System (IBAS)
8	B-Kit for M2A3 Commanders Independent Viewer (CIV)
9	Gen Two Sight (GTS) for the M8 Gunner's Primary Sight Subsystem (GPSS)
14	B-Kit for the LRAS3
6	B-Kit for Pre-Production Qualification Test-Contractor (PPQT-C) qualification

b. **LRIP Phase:** There will be two LRIP contract awards, one for approximately 216 B-Kits and the other for approximately 240 M1A2 sights. Tentatively, the first LRIP for B-Kits will begin in FY 97, followed in FY 98 with the M1A2 sight LRIP. [Ref. 22]

c. **Full Rate Production Phase:** This phase will produce the quantities necessary to equip the force and training base.

4. Delivery and Performance Period Requirements

The 2nd Gen FLIR EMD contract is a 42 month Cost-Plus-Award-Fee (CPAF) contract. Receiving platform PMs are responsible for concurrently contracting for A-Kit development with their prime contractor. B-Kit/sight qualification is required before entering LRIP. A Production Readiness Review (PRR) will precede the LRIP IPR and Milestone III decision. The LRIP contracts are currently expected to be Firm-Fixed-Price (FFP) contracts. [Ref. 22]

5. Test and Evaluation

The program requires the contractor to perform PPQT-C at the critical component, B-Kit, and sight levels. Pre-Production qualification Test-Government will be conducted at vehicle level and will include performance, EMI/EMP/EMC environmental, nuclear testing and system reliability.

TRADOC Dismounted Battlespace Battle Lab's Advanced Warfighting Experiment (AWE) will be used during development and Initial Operational test and Evaluation (IOT&E). AWE will be conducted in two phases. Phase one involves modeling and simulation while phase two is the IOT&E.

The 2nd Gen FLIR's Test and Evaluation Master Plan (TEMP) provides additional test and evaluation requirements, specifications, and milestones.

6. Contract Competition

The program's contract competition strategy is addressed in each of the production phases.

a. **EMD:** The Government released a competitive RFP on 15 December 1993, using full and open competition procedures. A single proposal was received from a Texas Instruments and Hughes Aircraft Co. team. This forced the proposal to be evaluated as a non-competitive procurement. The Texas Instruments and Hughes Co. team was awarded a 48 month EMD contract on 7 July 1994. The Government required developing two sources for all critical components, delivering product specifications and drawings for the B-Kit, sights, and major subassemblies with limited data rights. [Ref. 22]

Individual platform PM's are required to award A-Kit contracts to their prime contractors. This action was deemed appropriate based on the Government's and platform contractor's experience level.

b. **LRIP:** The EMD contract will contain an option for two LRIPs which will be awarded non-competitively. LRIP will ensure concurrently producing multiple sights and proofing the production line for production ramp up. The Government

recognized that it is not cost effective or practical to procure these systems from another contractor for LRIP. Therefore, a non-competitive contract will be required. [Ref. 22]

An Engineering Change Proposal (ECP) will be incorporated into individual platform's Technical Data Packages (TDP) to complete system integration. The platform prime contractor will receive the B-Kit/sight as Government Furnished Material (GFM). It is recognized that failure to provide the B-Kit/sight to meet platform integration schedules poses a significant risk to the program. [Ref. 22]

c. **Full Rate Production (FRP):** A FRP contract will be awarded under full and open competition. The Government will include data received from the EMD and LRIP phases in its RFP. During FRP, the B-Kit/sights will be provided to platform prime contractors for integration as Government Furnished Property. [Ref. 22]

d. **Component Breakout:** Component breakout will be analyzed for use during FRP. [Ref. 22]

E. SUMMARY

The 2nd Gen FLIR Program provides insight into the complexities associated with horizontally integrating technology across multiple platforms. The program has implemented several management initiatives, such as MOAs, to minimize potential risk and coordination problems. However, the most difficult aspect of the program still lies ahead. It must successfully produce the B-Kit and with the help of a separately produced A-Kit, fully integrate the FLIR into each of the four platforms identified in the 2nd Gen FLIR's Acquisition Plan and Acquisition Strategy.

The program's strong management base, to include the FLIR PMO and Team FLIR, fostered by guidance from key leaders at top levels of the Army, will certainly enable the program to be successful. 2nd Gen FLIR is helping to further solidify

the Army's HTI strategy by applying previously untested concepts.

IV. ISSUES AND ANALYSIS

A. INTRODUCTION

The purpose of this chapter is to further examine critical aspects of the Army's HTI strategy and implementation as presented in Chapters II and III. This is accomplished through discussing/analyzing issues within the HTI strategy's management, operational requirements/performance, and funding functions. Each issue is addressed individually, with the discussion being followed by a recommendation. The recommendation is presented as a consideration for future applications to the Army's HTI strategy.

B. MANAGEMENT

- 1. Issue: Is the Army's HTI acquisition policy sufficient for future programs?**

Since HTI is a new method of modifying or upgrading the force, the Army must continue to refine its management guidance for implementing the strategy. These policy changes must reflect the dynamics of horizontal integration programs. The three current enabling strategies have already laid the foundation for many future policy improvements.

HTI programs present extremely complex coordination and cooperation requirements. These requirements demand clearly defined lines of responsibility among acquisition individuals to include users, PMs, contractors, and DA Staff. The 2nd Gen FLIR Program implemented a variety of coordination measures in support of the program's multiple platform requirement. It is one of the first HTI programs to document the extensive coordination between multiple users, technicians, and PMOs. [Ref. 25] Despite several uncertainties and unrefined Army guidelines, 2nd Gen FLIR continues to set a precedence for A-Kit and B-Kit procurement and integration execution.

HTI acquisition policy must continue to improve as the horizontal procurement database grows. Improvements must

allow future HTI programs the flexibility to tailor their program to a variety of unique requirements and restrictions. This further complicates DA's responsibility to establish firm directives and modifications to existing acquisition documents. Adapting regulations and policy to a new and innovative procurement strategy requires critical review and deliberate action.

Recommendation: The Army needs to scrutinize each HTI enabling strategy's Acquisition Plan, Acquisition Strategy, and implementation lessons learned in an effort to standardized HTI procurement policy. Following this review, the Army's policy should be refined as appropriate to reflect new HTI initiatives, guidelines, and policy. Receiving and analyzing feedback is viewed as a critical step in many management models.

2. Issue: Need for Executive Involvement/Oversight.

HTI has quickly gained momentum as an acceptable modernization strategy. The strategy's success can be attributed to endorsement by the CSA and senior leadership throughout the Army. Because of the high level support, HTI acceptance continues to trickle down through the ranks of the Army, but there are many who remain skeptical of the "horizontal" approach to modernization.

If HTI doesn't remain at the top of the CSA's agenda, the result could be disastrous for the HTI program. Recall the fate of other attempts at common technology integration described in Chapter II. A lack of full acceptance by leaders in the Army helped cause the death of these programs. HTI will survive only if the strategy receives continued executive endorsement, oversight, and participation.

Recommendation: Involving executive leadership is the only way to ensure traditional stovepipe processes adjust to accept the HTI modernization strategy. Involvement requires

using the HTI GOWG, STF UAG, and Team ESCs created to facilitate a program's success. Also, periodic progress briefings to executive leaders will help HTI retain the power and influence needed to break the traditional vertical modernization procedures. Past experience shows that executive involvement is critical in the development of new programs which involve a deviation from "business as usual."

3. Issue: Is there a need for an HTI Directorate at DA and PEO levels?

Addressing the PEO and DA organizations separately will help clarify the discussion.

a. **PEO HTI Office:** Initially, the 2nd Gen FLIR Program experienced significant coordination difficulties, including establishing responsibility for A-Kit development and testing. PEO ASM recognized that the 2nd Gen FLIR HTI Program would directly affect several platforms under his control. Realizing the coordination requirements within his organization, he created the PEO ASM HTI Directorate (now PM ASI) as a conduit between PEO ASM platform PMs and the 2nd Gen FLIR PM.

The PEO ASM's decision created a dynamic central management office to facilitate coordination requirements, taskings, scheduling, and other horizontal integration issues. PEO ASM's HTI Directorate has been commended on its pivotal role in the 2nd Gen FLIR's initial development. The office coordinates HTI issues for PEO ASM with all Army agencies including, DA staff and other PEOs.

b. **DA HTI Office:** As the three developing HTI strategies mature, the need for a small DA HTI office increases. A DA HTI office could capture, compile, and assimilate the lessons being documented by the HTI programs. The office should act as the central authority to initiate and staff recommendations for HTI acquisition policy changes.

The DA HTI Office would provide focused insight into HTI process improvements. They could serve as a DA focal point

where issues presented by HTI PMOs, PEO HTI Directorates, and other staff agencies can be surfaced and resolved.

Recommendation: PEOs who have more than one platform identified for HTI should consider creating an HTI Directorate, who is responsible for coordinating platform PMs and HTI PMs. Also recommended is a temporary DA HTI Office to assess HTI programs now in progress and resolve HTI issues. The HTI Office's primary directive should be to suggest valid acquisition policy reform designed to enhance and facilitate the future implementation of HTI strategies. Perhaps PEO ASM set a precedence for allocating resources to ensure successful management of the HTI strategy.

4. Issue: Is there potential for cross-Service utilization of the Army's HTI Strategy?

For certain strategies, like Digitization, a DoD joint effort seems appropriate. Numerous historical examples exist where the lack of common capabilities was detrimental to accomplishing the mission. A prime example is the incident in Grenada, where a U.S. soldier was unable to call for fire support, because his communication system was incompatible with that used by the firing units. The soldier finally used a telephone to complete the fire mission. Can the Services continue to operate in a stovepipe world much as the Army has for years, or is it time to focus on a more functional horizontal method to modernize all services?

The logical successor to the Army's HTI strategy would be a DoD HTI strategy. Efforts have been taken to make this vision a reality. Recently, the Marine Corps joined the Army in its Digitization of the Battlefield HTI Strategy. There are other examples of cross-Service integration in equipment procurement, including the SINGARS radio. Horizontal Technology Integration for the DoD has significant potential for improving common situational awareness across the entire combined arms battlefield and reducing LCC for the entire military.

Recommendation: The Army must continue to present its HTI strategy to DoD's executive leadership. It is DoD's responsibility to analyze the potential for HTI implementation across Service boundaries. Review for Joint application is consistent with guidance and recommendations from the Packard Commission and subsequent Defense Management Reviews.

5. Issue: Will HTI increase or decrease a program's schedule risk.

This issue was presented in Chapter II as an advantage of the HTI program. However, consolidating of the development effort for a particular piece of equipment, such as the 2nd Gen FLIR, has the potential to increase risk.

If systems are vertically procured there are separate development and test schedules. Under HTI, these schedules are consolidated into one development and test plan, thereby reducing the number of possible schedule slips or problems. However, if the HTI program's schedule slips, all platforms are affected. This leads to concern that HTI programs may, in fact, increase the risk of schedule slips for all systems.

However, HTI does help reduce overlapping management requirements and problems related to separate programs. Consolidation also focuses the PMO's effort on specific problems, such as scheduling, benefiting multiple platforms simultaneously. The potential payoffs of horizontal integration offset the price of schedule risk.

Recommendation: The Army must carefully consider each program identified for possible HTI application. Risk associated with the technology's development must be analyzed. Programs with low to moderate development risk may be more easily adapted to horizontal integration than a high risk program. Risk management considerations are outlined in the Defense Systems Management College's publication, *Risk Management Concepts and Guidance*.

C. OPERATIONAL REQUIREMENTS/PERFORMANCE

1. Issue: Redefining the ORD for HTI

According to current DoD and Army policy, the requirements in traditional ORDs are stated in operational terms. The material developer then converts those operational terms into performance specifications to produce the desired piece of equipment. This is the standard ORD process for vertically developing equipment. In contrast, an HTI ORD is designed to combine the requirements of several platforms, in an effort to produce a common piece of equipment. [Ref. 19]

First, each platform's ORD is reviewed to identify pertinent requirements. This entails looking at on-board weapon systems and identifying common and optimum capabilities that will satisfy all of the platforms. Then, working within the physical constraints of the platforms and the capability and constraints of the technology, analysis determines technical options. Once the available options are identified, a Trade-Off-Analysis (TOA) determines which common features can be put in all of the platforms to reduce logistics and optimize warfighting capability. The final step, and probably the most difficult, is obtaining a consensus from all proponent combat developers before preparing the HTI ORD. [Ref. 19]

Recommendation: That Army policy and regulations be adapted to incorporate the different HTI ORD structure. Make TRADOC one of the approval authorities on performance specifications, statements of work, and acquisition plans to enhance the HTI program's continuity. [Ref. 19]

2. Issue: Does HTI restrict the operational capability of platforms designated to receive the HTI technology?

This issue strikes at the very precept of HTI. Will horizontally integrating the Army's equipment be the "best" method of modernizing the CSA's Force XXI or is the traditional vertical method still the optimal choice?

There are individuals in the acquisition community who feel that using common technology in multiple platforms restricts the overall development of the individual systems. It is true that all platforms identified for HTI are bound by the operational requirements outlined in the "common" ORD. Therefore, it would seem critical for the designated STF to include the proper representation from the user, PMO, and DA staff for each platform receiving HTI.

The ORD process discussed in the previous issue statement clearly shows that each platform's specific operational requirements are considered for integration into the final HTI ORD. However, as pointed out by HTI opponents, some systems may actually be forced to accept a compromise in total system performance and integration, to facilitate the HTI modernization plan. The level of compromise a system may be forced to accept depends on the individual program, technology being integrated, and platforms identified in the ORD for integration.

Certainly, the Army's decision makers are aware of the limitations HTI may place on certain systems identified for HTI. However, their overriding concern is to obtain a modernized force with common capabilities, that is cost effective and still meets the Force XXI requirements. Even though horizontal integration may restrict an individual system's performance potential, the benefit of common situational awareness and information transfer across multiple systems is overwhelming.

Recommendation: STF membership must include representation from each HTI platform's users, PMOs, and DA staff. As explained earlier, the Army's leadership must continue to emphasize the positive aspects of HTI. They must hold platform PMs responsible for successfully integrating the HTI technology in their system.

D. FUNDING AND COST

1. Issue: Is current Army funding policy adequate for HTI programs?

When the 2nd Gen FLIR HTI program began, the STF and PMO noted that DA funding policy inadequately addressed the program's budgeting needs. The program experienced considerable confusion over distributing and controlling program funds between B-Kit and A-Kit PMs. The problems were amplified when PM FLIR was given the additional responsibility of developing the A-Kit for selected platforms. [Ref. 19]

Chapter II presented three DA funding management proposals. These recommendations were based on potential funding needs and only superficially solved the program's funding difficulties. 2nd Gen FLIR has since successfully negotiated some of the funding tribulations inherent in a new acquisition strategy.

Some HTI programs will use the A/B Kit configuration, while others may incorporate alternative integration methods. Each program must retain the flexibility to adapt program funding to their specific requirements, within the framework of DA policy. Therefore, DA policy should provide several funding initiatives to allow tailoring for varying HTI programs.

Recommendation: DA should review the fund management techniques executed by the 2nd Gen FLIR PMO, to establish firm HTI funding management policy to curtail problems encountered in distributing program funds.

2. Issue: Will HTI give the expected LCC benefit compared to traditional procurement programs?

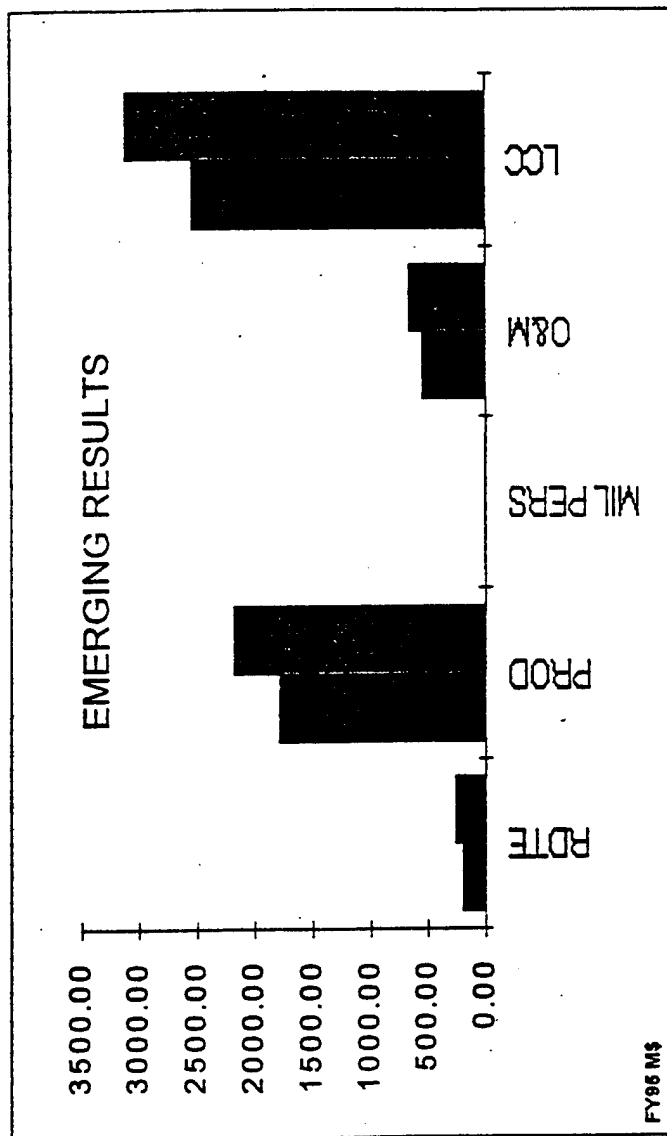
The analysis for this issue references the 2nd Gen FLIR cost analysis conducted by the Dismounted Battlespace Battle Lab, TRADOC Analysis Command, and White Sands Missile Range. This study compares the 2nd Gen FLIR HTI procurement cost to

a traditional stovepipe 2nd Gen FLIR procurement. The facts and assumptions of the study are: [Ref. 30]

- Initial 2nd Gen FLIR effort is for 6251 FLIRs
 - 1079 M1A2, 1602 M2A3, 239 M8, and 650 LRAS3
 - Includes two each (FLIRs) for Abrams and Bradley
- Fixed Costs
 - In HTI, apportioned across four systems
 - In stovepipe (STP), charged to each separate system
- A-Kit testing was relatively equivalent for the HTI or STP approach
- B-Kit testing
 - In HTI, apportioned across four systems
 - In STP, charged to each system
- Acquisition schedules were the same for both procurement methods (HTI or STP)
- Costs are in FY95 millions of dollars

Figure 11 is the LCC of both procurement strategies separated into the four life-cycle categories and a LCC total. Common component development reduces RDTE costs compared to separate components for multiple systems. These savings, plus savings from economies of scale in the HTI production method, helped create a combined saving of 22% over the STP method.

Figure 12 is the LCC of HTI and STP procurement categorized by individual system. The most startling figure is the 56% savings estimated for the AGS 2nd Gen FLIR. The savings result from economies of scale obtained through HTI procurement. If AGS developed and produced the 2nd Gen FLIR independently, the AGS program would only develop and produce 239 FLIRs. The 2nd Gen FLIR HTI program's effort is for 6251



HTI	200.33	1788.48	8.43	553.73	2548.97
STP	259.49	2179.94	8.43	666.46	3114.32
\$ SAVINGS	59.16	393.46		112.73	565.35
% SAVINGS	29.5%	22.0%	0.0%	20.4%	22.2%

Figure 11. Life Cycle Costs By Category

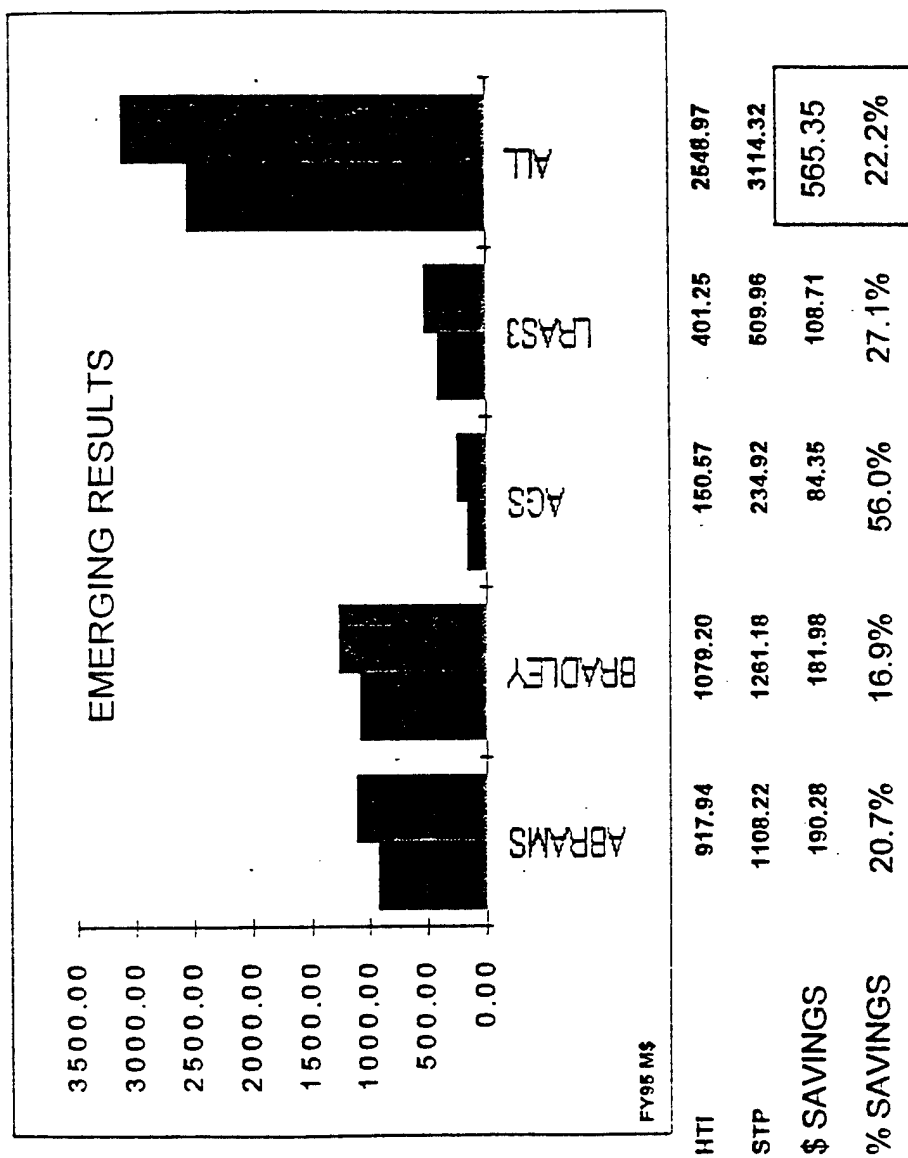


Figure 12. Life Cycle Costs By Platform

FLIRs. Therefore, AGS benefits from horizontally integrating the 2nd Gen FLIR across multiple systems.

The overall LCC savings for the 2nd Gen FLIR HTI program are estimated at \$565.35 million or 22.2% above the STP program. Although these figures are significant, several leaders in the Army believe this estimate to be conservative. They believe the actual HTI savings to be closer to 30% above traditional STP acquisition programs.

Recommendation: Conduct a follow-up cost analysis once the 2nd Gen FLIR HTI program completes the EMD phase. This will validate or disprove the cost estimates presented by the Dismounted Battlespace Battle Lab analysis. Analysis review and documentation is the last step in the estimation process. [Ref. 31]

E. SUMMARY

The preceding sections of this chapter discussed/analyzed several HTI issues. First, HTI management concerns were addressed. Next, the focus was on HTI performance/operational requirements discussion. Finally, funding and cost issues were presented, including a cost comparison analysis of HTI and stovepipe procurement methods. Each issue was concluded by a recommendation aimed at improving the Army's HTI strategy and stimulating follow-up research. However, the issues presented in this chapter are not a comprehensive list of HTI concerns. They represent the most common questions arising from the HTI strategy's policy and implementation.

V. CONCLUSION AND RECOMMENDATIONS

A. INTRODUCTION

The focus of this research effort was to document the HTI concept and how this concept has been implemented by the 2nd Gen FLIR program.

As a new and emerging modernization strategy, HTI has received limited research and documentation. HTI's enabling strategies are far from complete, but they offer solid information on HTI implementation.

This thesis combines the general concept of the HTI strategy with the practical experience of an HTI program to give greater breadth and continuity to understanding this new procurement methodology. This was accomplished by interviewing key HTI personnel and extensively researching the HTI strategy and the 2nd Gen FLIR program. The following conclusions, recommendations, and areas for further research are based on the study.

B. CONCLUSIONS

- 1. HTI is a viable acquisition strategy for modernizing and upgrading the combined arms force.**

The HTI concept was introduced to augment, not supplant, the traditional stovepipe modernization process. At a time when budgets are steadily decreasing, alternative procurement methods are being sought to increase the value for each acquisition/modernization dollar spent. HTI, as an alternative acquisition strategy, provides the Army significant LCC savings through economies of scale and long-term logistical supportability.

HTI helps the Army meet its Force XXI modernization goal of common situational awareness across the force. With the coming Information Age, a common view of the battlefield becomes critical to mission accomplishment. Using the horizontal integration strategy increases lethality, reduces

fratricide, and enhances command and control through common information sharing. HTI ensures multiple systems are outfitted with the common hardware, software, and protocols necessary to facilitate information transmission, reception, and assimilation.

The Army's HTI strategy is still in its early development stage, with significant improvements needed to refine its policy and guidelines. However, HTI is an acquisition strategy that has the potential to bridge the gap between reduced procurement funding, acquisition streamlining, and the Army's modernization goals.

2. HTI does have potential as a Joint Acquisition Strategy.

The HTI strategy holds tremendous potential for expanding across Service boundaries. Not only does the Army need to effectively communicate internally, it must communicate to other Services with equal ease. Rapid information transfers and common situational awareness serve as combat multipliers on the multi-Service battlefield.

With significantly reduced personnel, Joint operations have become more of a necessity than a luxury. The increased interaction required in multi-Service operations creates more opportunities for fratricide and devastating command and control breakdowns. HTI gives the same advantages to the Joint operations scenario as it does to the Army, the ability to win decisively on the battlefield with minimum casualties.

However, there are significantly more obstacles in developing a horizontal integration program when more than one Service is included. For instance, generating an ORD will become extremely complex when the individual Service's mission requirements are addressed. Although many of the problems seem insurmountable, the rewards will be great if concessions and agreements can be reached.

DoD must analyze the success of the Army's HTI strategy to ascertain its Joint applications. As the Army's strategy

matures, more policy and implementation procedures may be transferable to cross-Service integration programs. Cautious and deliberate steps must be taken to properly integrate the Services to inter-operational levels.

3. Conduct analysis of total system performance requirements before each platform is selected for horizontal integration.

If the Army expects to benefit from common modules, some performance trade-offs must be expected. In Chapter IV this study described the ORD development process. During the HTI ORD process, each platform's integration requirements are presented, analyzed, and consolidated. The common module is developed from the most stringent specifications of the consolidated requirements. The common specification should produce the best design for any platform. Unfortunately, not every specification is applicable across the spectrum of platforms. Therefore, individual system performance may actually be compromised by the integration process.

The Army's leadership must accept some performance trade-offs to attain the commonality benefits. As seamless information transference becomes almost a requirement, this trade-off becomes more of an imperative than an option. Although total system performance must be carefully analyzed, commonality through systems integration remains one of the Army's prime modernization directives. The level of compromise acceptable for an individual system is the critical question to answer in the pre-selection platform analysis.

4. Current DA policy does not adequately address HTI program requirements.

DA policy was designed to accommodate the traditional stovepipe process that drives our procurement programs. The three enabling strategies now in progress have adhered to DA policy whenever possible, but significant deviations have been required. As a new acquisition strategy, departures from traditional policy are expected.

DA needs to incorporate issues, such as funding and HTI acquisition streamlining, in policy amendments. If new HTI policy is not united with acquisition reform, the process will become cumbersome and difficult like current processes. The bottomline is: HTI holds tremendous potential as a method to streamline force modernization if DA policy reflects the operational needs of the new strategy.

C. RECOMMENDATIONS

- 1. Conduct cost/benefit analysis of the three HTI enabling strategies in progress to validate anticipated savings and benefits from component commonality.**

As the three HTI programs mature, cost data will be available for follow-up comparative cost studies with vertical acquisition programs. Near-term studies need to address initial development and production cost. Long-term projects need to be developed as HTI products are fielded and operation and support cost data becomes available. These studies will verify the projected LCC savings achieved through economies of scale and long-term logistical supportability. Without thorough cost/benefit analysis the HTI strategy will never realize its full potential or acceptance.

- 2. Form a DA HTI Office to accept, analyze, and process recommended changes to DA acquisition policy.**

The Army's HTI framework is new and untested. Procedural lessons are being learned from the enabling strategies. A central DA HTI Office is imperative to capture and synthesize these lessons for prospective policy adjustments.

The DA HTI Office should also be a champion of the strategy. They can provide information briefings to top executives on implemented and projected HTI programs. Other tasks may include DA level actions required by key committees, such as the GOWG. A DA HTI Office is warranted and should

prove invaluable as the Army's latest acquisition strategy continues to evolve.

3. Army leadership must continue to endorse the HTI strategy.

Endorsement of the HTI strategy by top Army executives requires continually recognizing the program and participating in several Executive Committees identified in this study. Direct involvement propels the HTI strategy to the forefront of the CSA's modernization agenda.

Only support from the highest levels of the Army enables HTI to break vertical process barriers. Remember, the HTI process is a new management philosophy which is slowly gaining acceptance in the acquisition community. Unfortunately, key elements to the program's success, such as complete platform PM cooperation, remain a challenge to HTI PMs. Only continued emphasis and education throughout the Army's hierarchy will ensure that HTI remains an alternative procurement strategy for force modernization.

D. ANSWERS TO RESEARCH QUESTIONS

This study proposed to answer the following research questions. The questions and their answers appear below:

1. Primary Research Question

How is the Army implementing an HTI procurement strategy?

The Army's HTI procurement policy is detailed in Chapter II. This chapter outlines the proposed procedure for an HTI program's initiation and execution. The 2nd Gen FLIR case study in Chapter III describes one HTI program's implementation of the Army's policy.

2. Subsidiary Question One

What is HTI and what HTI procurement policy has the Army adopted?

The HTI concept is defined and explained in Chapter II of this study. Chapter II also outlines the Army's current HTI acquisition guidance and policy.

3. Subsidiary Question Two

What is the HTI process from development to production?

The Army's guidance on the HTI process is outlined in Chapter II of this study. The 2nd Gen FLIR study describes one HTI program's progress through the Army's HTI process. However, the 2nd Gen FLIR program has just entered the EMD phase of development, limiting the availability of production data.

4. Subsidiary Question Three

What are the exact responsibilities of the PMs involved in HTI, specifically HTI component PMs and platform PMs?

The response to this question is found in chapter III. However, this case only presents one example of responsibility division among the PMs. Individual HTI programs will tailor PM responsibilities based on specific component and platform circumstances and requirements.

5. Subsidiary Question Four

What changes to the Army's existing policy will improve the overall HTI procurement process?

Several of the Army's HTI policy issues and concerns are addressed in Chapter IV of this study. Each issue is discussed and analyzed to provide a recommendation for improving or building on the HTI strategy.

6. Subsidiary Question Five

What is 2nd Gen FLIR? How, why, and when did the 2nd Gen FLIR become an HTI program? What is its current Acquisition Strategy, specifically HTI requirements?

The response to this question is found in Chapter III of this study. It describes 2nd Gen FLIR and the program's historical background, and reviews the program's Acquisition Strategy and Acquisition Plan.

E. AREAS FOR FURTHER RESEARCH

1. Analyze the effect of the HTI process on contractors.
2. Joint application of the HTI strategy by DoD.
3. Use of CAD and simulation in the HTI process.
4. Comparative analysis of two or three current HTI enabling strategies.
5. Horizontal and vertical acquisition cost comparison.
6. Case study of Digitization or Battlefield Combat Identification System.

APPENDIX. LIST OF ACRONYMS

AAE	Army Acquisiton Executive
ACAT	Acquisition Category
AMC	Army Material Command
ASA	Assistant Secretary of the Army
ASA RDA	Assistant Secretary of the Army Research Development and Acquistion
ASARC	Army Systems Acquisition Review Council
ASM	Armored Systems Modernization
AWE	Advanced Warfighting Experiment
BCIS	Battlefield Combat Identification System
CDR	Critical Design Review
CIV	Commanders Independent Viewer
CITV	Commanders Independent Thermal Viewer
CPAF	Cost-Plus-Award-Fee (contract)
CSA	Chief of Staff of the Army
DA	Department of the Army
DISC 4	Director of Information Systems for Command, Control, Communication, and Computers
DoD	Department of Defense
DCSOPS	Deputy Chief of Staff for Operations and Plans
DCSOPS-FD	Deputy Chief of Staff for OPerations and Plans Force Development??????
DTC	Design-to-Cost
DTUPC	Design-to-Unit-Production-Cost
ECP	Engineering Change Proposal
EMC	Electromagnetic Compatibility

EMD	Engineering and Manufacturing Development
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
ESC	Executive Steering Committee
FAR	Federal Acquisition Regulations
FFP	Firm-Fixed-Price (contract)
FLIR	Forward Looking InfraRed
FRP	Full Rate Production
GFM	Government Furnished Material
GOWG	General Officer Working Group
GPSS	Gunner's Primary Sight Subsystem
GTS	Generation Two Sight
HQDA	Headquarters, Department of the Army
HTI	Horizontal Technology Integration
IBAS	Improved Bradley Acquisition System
IEW	Intelligence and Electronic Warfare
IOT&E	Initial Operational Test and Evaluation
IPR	In-Progress/Process Review
IPS	Integrated Program Summary
LCC	Life Cycle Cost
LRAS3	Long Range Advanced Scout Surveillance
LRIP	Low Rate Initial Production
MDEP	Management Decision Package
MOA	Memorandum of Agreement
MWG	Management Working Group
NV/RSTA	Night Vision Reconnaissance Surveillance and Target Acquisition

ORD	Operational Requirements Document
PAT	Process Action Team
PDR	Preliminary Design Review
PE	Program Element
PEO	Program Executive Officer
POM	Program Objective Memorandum
PM	Product Manager/Program Manager/Project Manager
PPQT-C	Pre-Production Qualification Test-Contractor
PPQT-G	Pre-Production Qualification Test-Government
PRR	Production Readiness Review
RFP	Request For Proposal
SES	Senior Executive Service
SOW	Statement of Work
SSN	Special Study Number
STF	Special Task Force
STP	Stovepipe Process
TDP	Technical Data Package
TECOM	Test and Evaluation Command
TEMP	Test and Evaluation Master Plan
TOA	Trade-Off-Analysis
TRADOC	Training and Doctrine Command
UAG	User Advisory Group
USAIC	United States Army Infantry Center
VCSA	Vice Chief of Staff of the Army
2ND Gen FLIR	Second Generation Forward Looking InfraRed

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